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ABSTRACT

This activity guide corresponds to a college television course titled, "Race to Save the Planet," though it is designed to be used independently of or in conjunction with viewing the series. The goal of the guide is to aid teachers in incorporating topics relating to environment in the classroom. The guide is made up of three main sections: activities, reproducible student pages, and resources. The activities section is divided into 10 units with the following themes: history, climate, overdevelopment, development, wilderness, energy, agriculture, waste, politics, and sustainability. Each unit is organized into sections that include an overview, activities, questions, key words, a program synopsis, and recommended readings. The reproducible student pages feature articles and information that encourage students to grapple with the issues and to consider their roles in environmental problem solving. This section also includes information about careers, volunteer opportunities, summer activities, and educational resources. The resource section provides a sampling of educational organizations and materials. Also included is an examination of the activities of the Education for Living in the Nuclear Age group in an effort to inspire teacher collaboration. (Author/MCO)

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Environmental

issues

across the

curriculum

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Ordering Information

Additional copies of the *Race to Save the Planet* Activity Guide are available for $3 each to cover postage and handling (bulk rates also available, call (617) 492-2777, extension 3875). Please send checks payable to WGBH Race to Save the Planet Guide to:

Race to Save the Planet
Activity Guide
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Introduction

The *Race to Save the Planet* College Television Course

The college telecourse consists of the series, a telecourse faculty guide, student study guide, a choice of two textbooks, and two supplementary texts (see **Recommended Readings** on page 2). Together, the course components introduce broad concepts and scientific terms fundamental to ecology and they examine the major environmental issues through a variety of case studies. For further information, see **Resources**.

In the past few years, the future of our environment has become one of the most pressing issues in this country and around the world. Environmental problems disregard borders and are intertwined with politics and economics, affecting and threatening us all. While Earth Day rallied hundreds of thousands of people, the greatest challenge ahead lies in maintaining that momentum and in translating our concerns into action and legislation. Education is one of the most powerful tools we have for ensuring a better future.

Environmental education in the classroom

Educators have the opportunity to play an important role in the process of empowering students and encouraging thoughtful activism. The values teachers espouse greatly influence the attitudes their students take with them from the classroom and the choices they will make as they become active members of society.

While environmental science is an established subject area, environmental education as a whole is an interdisciplinary study, integrating science, literature, social studies, philosophy, political science, geography, economics, math, fine arts, and industrial arts. As a result, teachers in all areas can include elements of environmental education in their classrooms.

Educators need not revamp their entire curriculum to focus on environmental issues. In many cases, assignments and activities can be modified slightly to include environmental topics while teaching larger concepts. Often a writing assignment, art project, word problem, or science experiment can be recast to focus on an environmental issue.

In designing an environmental unit, one point should be kept in mind. Although teaching broad concepts and holding discussions about environmental issues are important, hands-on activities should be included as well. Students need to be actively involved in solving environmental problems in order for the lessons they learn in the classroom to translate into their daily lives. Teachers and students can work collaboratively with their communities to tackle local environmental problems. Once students appreciate the impact of environmental issues in their own backyard, they can begin to understand how similar issues face other communities and other countries, and so develop a global perspective on a truly global problem.

Collaboration between teachers in different subject areas will broaden the impact of environmental activities by any one teacher. While biology students are introduced to the fundamentals of ecology, chemistry students can experiment with the production of methane, social-studies students can follow the twists and turns of the Clean Air Act, English students can read *Walden*, the industrial arts class can build solar panels, math students can study exponential growth, and art students can participate in a "recycled-art" contest. Together, the entire school can plan an environmental celebration or fund-raising campaign.

Using the series

Race to Save the Planet, a ten-part series produced by the WGBH Science Unit (producers of *NOVA*), examines the major environmental questions facing the world today. It will be broadcast on PBS beginning in October 1990. The entire series will air 9-11pm on October 7-11. Most stations will also air the series weekly starting the week of October 1. Check with your local public television station for the broadcast schedule in your area.

Race to Save the Planet is also the basis of an Annenberg/CPB college television course in environmental science (see the box above). Because the series is part of a college course, using it in the high school classroom may not be appropriate for all levels and subject areas. You may want to tape and preview programs before assigning them to students. This guide is designed to be used independently from the series, although the programs can be used as a resource.

Programs in the series may be taped off the air and used for educational purposes within seven consecutive school days. Your school can also purchase an off-air taping license. The license costs $100 for the series, $15 per program (for one set of tapes for life-of-tape). Call 1-800-LEARNER or the PBS Adult Learning Service at 1-800-257-2573.

Use this series in whatever ways are appropriate for a particular class. If you are taping the series, it may be necessary to show each one-hour program in two parts to accommodate class periods. Alternatively, after taping and previewing a program, you may choose to select and show only those segments that support the concepts you are teaching. An option to classroom viewing would be to assign the programs as homework assignments.

Different programs will fit into different subject areas. While the whole series may support an environmental science curriculum, "Remnants of Eden" (program 5 on wilderness and biodiversity) might be particularly useful to a biology class and "Waste Not, Want Not" (program 8 on waste and recycling) might work well in social studies. Work together with teachers in different subject areas to use the series in a complementary fashion.

The Television Programs

Title	Theme
The Environmental Revolution	History
Only One Atmosphere	Climate
Do We Really Want to Live this Way?	Overdevelopment
In the Name of Progress	Development
Remnants of Eden	Wilderness
More for Less	Energy
Save the Earth – Feed the World	Agriculture
Waste Not, Want Not	Waste
It Needs Political Decisions	Politics
Now or Never	Sustainability

Using this guide

The *Race to Save the Planet* Activity Guide may be used either independently of or in conjunction with viewing the series. The overall goal of this guide is to help you incorporate topics relating to the environment into your classroom. We hope to inspire you and give you the tools to continue exploring environmental themes and issues. Above all, we want to raise the environmental awareness and sense of empowerment of both you and your students.

This guide is not meant to provide a complete environmental curriculum or to teach ecological concepts. Instead, its purpose is to give you activity ideas to illustrate these concepts and to show you where to go for more information. We also hope to help you find ways to modify your current activities to incorporate environmental lessons and issues.

This guide is made up of three main sections: **Activities**, **Reproducible Student Pages**, and **Resources**. The **Activities** section is divided into ten units that coincide with the ten themes covered in the programs listed in the box on page 1. Each unit is organized into sections that include an *Overview*, *Activities*, *Questions to Consider*, *Key Words*, a *Program Synopsis*, and *Recommended Readings*.

The *Overview* briefly states the theme of that unit. Because this is a multidisciplinary guide, the *Activities* section includes suggested activities relating to any of six broad subject areas – art, English, geography, math, science, and social studies (see Subject Key above). You can also use activities outside of your subject area by adapting them for your own use, or you may find ways to work together with teachers in other subjects.

The *Questions to Consider* section does not require a deep understanding of ecological concepts but is designed to spark discussion and help students examine their own values. *Key Words* includes vocabulary that teachers and students are likely to come across in the media and in the general study of environmental issues. The *Program Synopsis* describes briefly the corresponding program and is designed to help you decide whether it is appropriate viewing for your students. The *Recommended Readings* section is geared specifically for the teacher to garner further information about each subject. However, you may wish to assign the materials to students as well.

The **Reproducible Student Pages** is a six-page section for you to distribute to your students. The pages feature articles and information that encourage students to grapple with the issues and to consider their own roles in solving the problems discussed. In addition, the section includes information about careers, volunteer opportunities, summer activities, and educational resources.

The **Resources** section provides a sampling of educational organizations and materials. Due to space constraints, it is not possible to list all the sources uncovered in our research. However, information on where to find more complete listings is included.

The page following this introduction examines **Educating for Living in the Nuclear Age (ELNA)**, a group created by the collaborative efforts of teachers in Massachusetts and Oregon and Boston Area Educators for Social Responsibility. We offer the section on this group and its environmental activities in the hope that it will inspire collaboration among other teachers.

Subject Key

Use these symbols to find the activities appropriate to your subject area.

Art
Units 1, 4, 5, 7-10

English
Units 1, 3-5, 7, 9, 10

Geography
Units 1-7, 9, 10

Math
Units 3, 6-8

Science
Units 1-10

Social Studies
Units 1-10

Recommended Readings

The following books are integral parts of the *Race to Save the Planet* college telecourse. They are valuable resources for teachers and in some cases may be appropriate for student assignments.

- Brown, Lester R., et al. *State of the World 1990*. New York: W. W. Norton & Company, Inc., 1990. (212) 354-5500.

This is the latest in a series of annual reports from Worldwatch Institute that inspired development of the *Race to Save the Planet* television series. It provides an up-to-date and thoroughly documented overview of the earth's ecological health.

- Goldfarb, Theodore D., ed. *Taking Sides: Clashing Views on Controversial Environmental Issues*. Guilford, Conn.: The Dushkin Publishing Group, Inc., 1989. (203) 453-4351; (800) 243-6532.

This collection of essays provides opposing viewpoints on a number of contemporary environmental issues.

- Miller, G. Tyler, Jr. *Environmental Science: An Introduction*. 2nd edition. Belmont, Calif.: Wadsworth Publishing Company, 1989.
- Miller, G. Tyler, Jr. *Living in the Environment*. 6th edition. Belmont, Calif.: Wadsworth Publishing Company, 1990. (415) 595-2350.

The two Miller books, *Environmental Science: An Introduction* and the expanded version, *Living in the Environment*, are introductory college textbooks that present fundamental ecological concepts.

Calvin and Hobbes

by Bill Watterson

YOU'RE PACKING?
YEP. GET YOUR TOOTHBRUSH, HOBBES. WE'RE OUTTA HERE.
IT'S AN OUTRAGE. HOW GROWN-UPS HAVE POLLUTED THE EARTH! I REFUSE TO INHERIT A SPOILED PLANET! I'M LEAVING!
REALLY? WHERE TO?"
YOU KNOW, SOMETIMES YOU'RE A REAL LOAD TO HAVE AROUND.
I WAS JUST ASKING!

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ELNA

Educating for Living in the Nuclear Age

The ELNA project began in 1985 as a response to educators' concerns that young people were growing up without the skills and knowledge to cope with the unprecedented challenges of the nuclear age – an age in which we have realized both our capability for global destruction and our responsibility for ensuring the survival of the planet. In collaboration with the Boston Area Educators for Social Responsibility, ELNA brought together 12 local school districts, later joined by school districts in the Portland, Oregon area. ELNA's overall strategy, to develop leadership among teachers, is driven by the conviction that teachers need to feel empowered themselves in order to empower their students. The project identifies four major educational objectives for students and teachers:

- to understand the nature of social and ecological interdependence;
- to develop cooperation and conflict-resolution skills;
- to understand current social and political issues, especially the impact of nuclear technology, on the way we think about local and global issues;
- to participate in democratic decision-making about vital contemporary issues.

ELNA teachers meet and share ideas, lead workshops for colleagues, and plan professional development opportunities. They hope to help students develop a sense of social responsibility and to encourage them to share in the creation of a just, peaceful, and environmentally sound world.

As part of the 20th-anniversary celebration of Earth Day, ELNA developed the following activities to bring environmental education into various areas of the curriculum.

Art

- Design logos, wind socks, kites, and posters with environmental messages.
- Make collages, sculptures and other "junk art" out of recycled and found materials, and hold an environmental art contest.
- Have kids do drawings about how they view the world environmentally, and how they would like it to be.

English

- Create an environmental play; act it out for the student body.
- Have students write editorials to the school and local newspapers.
- "What if?" writing assignments (e.g., What if the water level of the oceans increased by a foot? What if all the trees were cut down?)
- Write essays and poems about the environment, expressing feelings about and hopes for the future.
- Write letters to companies about the environmental effects of their products or packaging.

Foreign Studies

- Research the manufacturing policies of multinational corporations. How do the manufacturing practices of certain corporations create environmental problems? Do their manufacturing practices and environmental responsibility vary according to the host country?
- Generate a vocabulary list of environmental terms and expressions in other languages.
- Study the ecological effects of tourism. Get information on socially and environmentally responsible travel.
- Study the effects of environmental problems on art and architecture in foreign countries.
- Contact environmental and political action organizations in other countries, such as the Green Party in West Germany or New Zealand.

Industrial Arts

- Teach students to caulk and weatherstrip, and then weatherproof the school.
- Build wooden recycling boxes with strings that make it easier to tie up newspapers.
- Make a solar water heater, a model solar home, a windmill, a water filter, or design a septic system; display.
- Research air pollution from solvents, sawdust, and paint fumes in industrial areas, and find solutions.

Math

- Analyze statistics that are used to support both sides of an argument.
- Study population curves and learn about exponential growth.
- Collect and display pollution graphs, tables, and projections.
- Study acid rain. Find historical data that correlate coal production with the increase in acid rain.

Science

- Research preservatives and pesticides that are used on foods.
- Study the use of road salt and weigh the conflicting interests of safety versus the environment.
- Survey the community for toxic wastes. Where are they? What kinds are there? How much is there? How are they disposed of?
- Study how wetlands purify water naturally and examine communities that are experimenting with this property for sewage treatment (e.g., Harwich, Mass., Arcata and San Diego, Calif.).

Social Studies

- Review the environmental policies and actions of recent presidents, as well as directors of the EPA.
- Conduct a watershed study of a local river with the science department.
- Research worldwide governmental and nongovernmental efforts to regulate air and water pollution, ozone depletion, land erosion, hunger, and poverty.
- Observe and discuss the values concerning society and the environment that are promoted in advertising.
- Study companies and businesses that are trying to make environmentally sound changes or contributions, such as mass-transit companies, alternative-power companies, or supermarkets that recycle plastic or paper bags.

For more information about ELNA, please contact Shelley Berman at Boston Area Educators for Social Responsibility, 11 Garden Street, Cambridge, MA 02138.

History

Overview

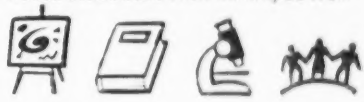
For thousands of years, human beings lived in hunting and gathering societies limited by and completely dependent on the natural environment. This relatively simple relationship was changed forever by the advent of agriculture between 12,000 and 10,000 years ago and the onset of the Industrial Revolution in the eighteenth century, both of which were

Activities

1 To help students put the modern way of life into perspective, have them make a timeline of human history for different regions, showing the progression of societies from predominantly hunting and gathering to subsistence agricultural to urban agricultural to industrial. Divide the students into groups and have each group research a particular continent or region. Color-code the timeline to show what was happening in different areas at the same time.

2 Scientific innovations can both create and solve social problems. Have students research specific innovations that they believe have either helped or harmed the environment. Examples include nuclear power, chlorofluorocarbons, and the catalytic converter. Why has it taken society a long time to recognize the potential negative effects of new technologies? How can we protect against this problem in the future? What factors encourage or discourage the development of new technologies to solve environmental problems?

3 The expansion of coal mining to provide the fuel for steam power lay the groundwork for the Industrial Revolution. Have students examine the technological, environmental, and social aspects of coal mining by creating a multidisciplinary multimedia display. Prepare a chart showing what coal is used for and the advantages and disadvantages of using it. Draw a diagram showing the history of technological innovation in coal mining. Make dioramas or posters showing the environmental consequences of mining and burning coal. Collect photographs of miners at work with captions describing working conditions. Post clippings on mining disasters, present statistics on health and safety, or chart the history of labor struggles fought between miners and mining companies. Read books about mining such as *How Green Was My Valley* by Richard Llewellyn (New York: The Macmillan Company, 1940). Films such as *Harlan County, USA* and *Matewan* raise questions about the economic and social issues associated with mining as well.



Bedouin tribesmen demonstrate an ancient technique for making plaster, using wood to burn limestone gathered from a cave.

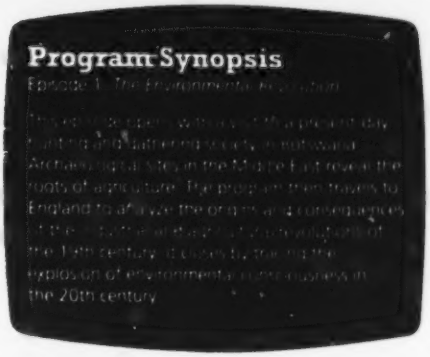
Key Words

agricultural revolution The transformation of human society from hunting and gathering groups to settled populations dependent on cultivated crops and livestock for food. The domestication of wild plants and animals first occurred between 10,000 and 12,000 years ago in the Middle East.

demographic transition A shift in the relationship between birth and death rates that occurs as a consequence of economic development. Nonindustrial societies are characterized by high birth and death rates.

accompanied by dramatic increases in population growth. Efforts to support these increases by intensifying the use of nature's resources have shaped the rise and fall of entire civilizations. Through it all, the human species has adapted and proliferated.

Our success as a species, however, has often been at the expense of the environment. Now we must face the results of our actions. Perhaps the global revolution in environmental awareness now taking place will lead to an essential restructuring in our collective use of the earth and its resources.



4 To dramatize the contrast in the use of natural resources between hunting and gathering societies and modern urban societies, have students consider what the carrying capacity of their community would be if all buildings and roads were removed and the original biome restored. Have them identify natural resources such as water supplies and take stock of native plant, animal, and fish species. When would food supplies be plentiful, and when would they be scarce? What species would compete with us for food or even prey on us? What problems would the climate pose, and what resources would we need to provide ourselves with shelter? What would we use for fuel? How many hunter-gatherers could the region support without exhausting its resources?

Questions to Consider

Should environmental activists be prosecuted for trespassing, vandalism, or interfering with the running of a business during protests, or do the ends justify the means?

The media is always shifting its focus and the public's attention to the issue of the moment. How can we keep the environmental movement alive?

5 The 1970s and 1980s have seen tremendous increases both in the popular level of environmental consciousness and in the government's role as protector of the environment. This is not a new phenomenon: similar outbursts occurred in the late 1800s and in the 1930s. Divide students into three groups to study the first, second, and third waves of environmentalism in the United States. Have each group consider the elements that inspired people to act. Make a chart of the major pieces of federal environmental legislation passed during these periods. Have members of each group present brief accounts of the lives and work of environmentalists of the period – John Muir, Theodore Roosevelt, or Rachel Carson, for example. Students might also write reports on books by John Muir or Rachel Carson. What spurred Muir and Carson into action? How has our perspective on the environment changed? Which debates have been settled and which remain? To what extent is our interest in the environment cyclic? How much progress have we made in our efforts to protect the environment?

6 Catch a glimpse of what life as a hunter-gatherer might be like. Read novels or other books by anthropologists or travel writers that describe the ways of life of present-day hunting and gathering groups. Some examples are *Nomads of the Long Bow* by Allan R. Holmberg (New York: The Natural History Press, 1969); *Keep the River on Your Right* by Tobias Schneebaum (New York: Grove Press, 1969); *The Harmless People* by Elizabeth Marshall Thomas (New York: Vintage Books, 1958); or *Stranger in the Forest: On Foot Across Borneo* by Eric Hansen (Boston: Houghton Mifflin, 1988). Ask students to discuss themes related to their readings. How are hunter-gatherers' relationships to nature and to one another different from ours? What values are characteristic of a hunting and gathering society? Is this kind of society being changed by exposure to other cultures? For better or worse? How well does this society meet its members' needs? How well would it meet your needs?

industrialized societies by low birth and death rates. When societies first shift from nonindustrial to industrial, they undergo rapid population growth as death rates decrease while birth rates remain high. As children's labor is no longer needed on the farm and they become an economic liability, birth rates begin to decline.

hunting and gathering society A society that depends entirely on its natural ecosystem for food and shelter. The limitations of natural resources demand that such a society remain small and mobile.

Industrial Revolution The dramatic expansion of industrial output that began in England in the 18th century through new technologies for using fossil fuels and steam power which allowed for the mechanization of production processes. In addition to generating unprecedented economic growth, the Industrial Revolution changed fundamentally the impact of humans on the environment.

Recommended Readings

Bronowski, Jacob. *The Ascent of Man*. Boston: Little, Brown & Co., 1974.

Carson, Rachel. *Silent Spring*. Boston: Houghton Mifflin Co., 1962.

Ehrlich, Paul, and Anne Ehrlich. *The Population Explosion*. New York: Doubleday, 1990.

Hays, Samuel. *Beauty, Health and Permanence: Environmental Politics in the United States, 1955-1985*. New York: Cambridge University Press, 1987.

Lowdermilk, W. C. *Conquest of the Land through 7,000 Years*. Washington, D.C.: United States Department of Agriculture, Soil Conservation Service, 1953 (reprinted 1986).

Perlin, John. *A Forest Journey: A History of Wood and Civilization*. New York: W. W. Norton & Co., 1989.

Udall, Stewart L. *The Quiet Crisis (rev. ed.)*. Layton, Utah: Gibbs Smith, 1988.

Ward, Barbara, and René Dubos. *Only One Earth*. New York: W. W. Norton & Co., 1972.

Climate

Overview

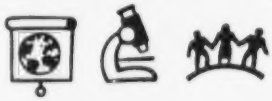
Two distinct issues – the depletion of the ozone layer and the prospect of global warming – have emerged at the top of the international agenda.

Once regarded as "a chemist's dream," the chlorofluorocarbons (CFCs) widely used in refrigerators, air conditioners, aerosol sprays, styrofoam manufacture, and the electronics industry have created an environmental nightmare. In the cold air high above the earth's surface, CFCs break down ozone into oxygen gas, letting in the dangerous ultraviolet

Activities

1 Ozone depletion provides vivid evidence of how humans can dramatically alter the environment. Under ultraviolet radiation, CFCs break down and release chlorine atoms, which react with ozone to convert it into two molecules of oxygen ($O_3 \rightarrow O_2$ O). The chlorine acts as a catalyst and is unchanged in the process, so it can go on to destroy more ozone. One chlorine atom can break up 100,000 ozone molecules. Help students grasp the chemical reaction through which CFCs destroy ozone by having them act out the parts of different elements, even making up a skit to "activate" each step involved.

2 The prospect of global warming challenges humans to find ways to adapt without causing new environmental problems or aggravating existing ones. Ask students to research alternatives to air conditioning. Have them investigate the measures people take to keep cool in other cultures. Clothing styles, building materials and design, and landscaping are some possibilities. Which changes could students adopt this summer? Which require more substantial investments of time or money? What steps would our society need to take to encourage citizens to keep cool without air conditioning?



3 To help students understand how weather works, have them make a relief map of their area and discuss how the topography of their environment affects local weather patterns. Ask them to list other factors that help to determine the climate they live in (latitude and global air currents, for example). How does the local climate affect the economy and culture of their community? How might changes in climate patterns elsewhere in the world affect weather patterns locally? How might these changes affect their own lives?

Key Words

chlorofluorocarbons (CFCs)
A class of synthetic chemicals that engage in a chemical reaction that destroys ozone molecules high in the atmosphere. Because CFCs insulate 20 times more effectively than carbon dioxide, they are also among the most potent greenhouse gases.

greenhouse effect The natural mechanism by which gases in the atmosphere allow sunlight to warm the earth's surface and then prevent that warmth from escaping back into space. Without this effect, global temperatures would be 50 degrees cooler.

radiation that ozone normally filters out. Increased exposure to ultraviolet radiation has the potential to cause malignant skin cancers, blindness due to increased incidence of cataracts, and immune suppression in humans, as well as the disruption of crop yields and ocean ecosystems.

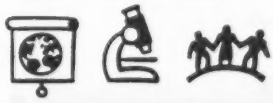
Global warming may wreak further havoc on our environment. Increased emissions of carbon dioxide, methane, and CFCs – the results of population growth, industrialization, and the destruction of the world's forests – have intensified the planet's natural "greenhouse effect." These transparent gases that let visible light reach the surface of the earth create a thermal barrier that prevents the escape of heat, specifically infrared radiation, back into space. Global average temperatures are predicted to rise anywhere from 3 to 18 degrees over the next 50 years, which could cause severe droughts, widespread flooding, and destructive storms.

Program Synopsis

4 To demonstrate the potential effects of rising sea levels, which may displace up to one-third of the world's population, divide students into teams and assign each team a region of the globe. Using an atlas, each group should determine the coastal areas that lie at or below sea level and the population centers most likely to be affected. Have each group present their findings and color in those areas on a large map of the world. Why are so many cities located on seacoasts or rivers? What would happen to people displaced from these cities? How would the rest of the country be affected if coastal cities were flooded (consider both population migration and the interruption of services)? How have areas prone to chronic flooding – such as Amsterdam, Venice, the Nile Valley, and Bangladesh – responded to this threat?

5 Students often confuse global warming and ozone depletion. Have the class make a chart listing the greenhouse gases involved in global warming (carbon dioxide, methane, CFCs, and nitrous oxide) along with the human activities responsible for the emission of these gases, and list the consequences. Make a similar chart for the chemicals responsible for depletion of the ozone layer (CFCs and halons). How are these problems different in terms of origin, mechanism, and range of effects? How are they similar? Can solutions to one problem contribute to the other (for example, using rigid insulation to reduce energy use and global warming contributes to ozone depletion through the CFCs used in manufacture)? Why have countries made more progress toward solving ozone depletion than global warming?

6 Ask students to brainstorm the possible consequences of rising global temperatures. These might include changes in rainfall patterns resulting in droughts and famine; the melting of polar ice caps, causing sea levels to rise and widespread flooding; changes in forest cover; changes in wildlife habitats and migration; disruption of marine food chains; and severe tropical and subtropical storms. Discuss ways that ecological feedback mechanisms (i.e., oceans, clouds, ice, soil) might offset or exacerbate the effects of warming. Which consequences would affect students most? Why? How might people's responses to global warming – such as turning up the air conditioner – make it worse?



Questions to Consider

If no substitutes for CFCs were discovered for use in air conditioners, would you do without air conditioning in your car or home?

Not all scientists agree about the existence of global warming. Is it worth the risk *not* to change our lifestyle?

What would you be willing to do to reduce global warming? Would you give up your car, start a car pool, turn down the heat, ride your bike, walk?

Sunbathing may be hazardous to your health.

malignant melanoma An often fatal form of skin cancer that can be caused by exposure to ultraviolet light.

methane A natural greenhouse gas produced by biological fermentation, present in rice paddies and marshes, manure, trash landfills, natural gas leakage, and melting polar ice caps (in the form of methane hydrate). Increasing methane emissions are largely a consequence of population growth and changing patterns of food production.

ozone hole The seasonal depletion of ozone levels by as much as 50 percent in a region of the stratosphere over the South Pole.

ozone layer The low concentration of ozone formed in the stratosphere. It protects humans and other organisms by filtering out ultraviolet radiation from the sun.

Recommended Readings

Abrahamson, Dean E., ed. *The Challenge of Global Warming*. Covelo, Calif.: Island Press, 1989.

Graedel, Thomas E., and Paul J. Crutzen. "The Changing Atmosphere." *Scientific American* 261 (September 1989): 58-68.

Jacobson, Jodi. "Swept Away: Rising Waters and Global Warming." *World Watch* (January/February 1989): 20-26.

Lyman, Francesca, with Irving Mintzer, Kathleen Courrier, and James MacKenzie. *The Greenhouse Trap: What We're Doing to the Atmosphere and How We Can Stop Global Warming*. Boston: Beacon Press, 1990.

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_____. "The Changing Climate." *Scientific American* 261 (September 1989): 70-79.

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Over-development

Overview

Industrialization and urbanization have brought affluence to many modern societies, but at an increasing cost to the environment. Population growth and economic expansion in urban areas are straining our resources to the limit. One billion urban dwellers – one-fifth of the world's population – are exposed to health hazards from air and water over-burdened with contaminants.

Over the last 20 years, governments in the Western industrialized countries have taken

Activities

1 Develop the connection between individual lifestyle choices and pollution, using cars as an example. Have students chart all the pollutants generated in automobile exhaust (such as carbon oxides, nitrogen oxides, petrochemical oxides, and volatile organic compounds) and some of the environmental and health consequences of each. Have students make a poster showing measures that individual drivers can take to minimize the amount of pollution they generate (e.g., buying high-mileage cars, car-pooling, having regular tune-ups, accelerating and braking gradually, maintaining tire pressure). Identify other ways that cars contribute to pollution (e.g., manufacturing, tire dumps and resulting fires, automobile graveyards, and the release of CFCs from air conditioners) and discuss alternatives to driving that are available in your community (e.g., public transit, bikes, trains, boats, walking). Invite the class to make a collective commitment to drive less.

2 Students often don't perceive the ramifications of exponential growth. One way to introduce this idea is to ask students whether they would rather have a weekly allowance of $50, or one that starts out at a penny but doubles each subsequent week. Have them figure out how much both allowances would generate after one year. To understand the effects of exponential growth on population, find out the population of your community or a nearby city. Have students project different rates of increase, such as 1 percent, 2 percent, or 5 percent per year, for the next 100 years and graph the results. See if they can derive the "rule of 70" to determine how fast a number will double at a given rate of growth: divide the growth rate into 70; e.g., a bank account growing at a rate of 10 percent a year will double in 7 years.

3 To get an understanding of the social forces that drive people to settle in certain areas and to migrate from one region to another, ask students to read and report on a novel that deals with urbanization and/or migration. Examples are *The Grapes of Wrath* by John Steinbeck (New York: Viking, 1989); *The Jungle* by Upton Sinclair (Urbana, IL: University of Illinois Press, 1988); *The Dollmaker* by Harriette Louisa Simpson (New York: Macmillan, 1954); *Call It Sleep* by Henry Roth (New York: Avon, 1964); or *Continental Drift* by Russell Banks (New York: Harper & Row, 1985). Discuss some of the common themes: economic displacement, loss of community, changes in values, hope for better opportunities. What choices do characters make and why? What conditions do they face, and how do they cope with them? How do values change along with experience? What personal gains or losses accompany these shifts in values?

Reducing automobile use could significantly reduce ozone and photochemical smog in urban areas.

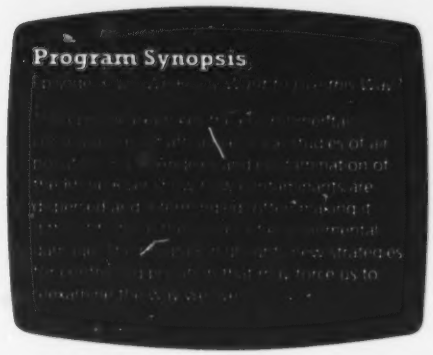
Key Words

eutrophication The asphyxiation of fish and other organisms that occurs when a body of water is polluted by runoff containing nitrates and phosphates which cause an explosive growth of algae. Decomposition of the algae consumes the oxygen in the water.

hydrocarbons Chemical pollutants released into the air when car and truck engines burn fossil fuels. Hydrocarbons are an important ingredient in smog.

significant steps to clean up contaminated air and water. In spite of these efforts, the levels of waste and pollution continue to increase. Automobiles alone account for 50 to 85 percent of urban air pollution. Successful efforts in the United States to reduce emissions from cars are beginning to be offset by increases in the number of cars on the road.

Technical solutions to the problem of pollution are no longer enough. Instead of cleaning up contaminants at the point where they reach the environment – so-called end-of-the-pipe solutions – we must curtail the activities that generate pollution in the first place. Strategies for protecting the environment must begin with the restructuring of urban lifestyles so that they are no longer organized around the luxuries of convenience, unlimited mobility, and infinite choice.



4 A coalition of environmentalists, bankers, and investors, known as the Coalition for Environmentally Responsible Economies, has formulated a set of guidelines for corporate conduct called the Valdez Principles (to order a copy, see Resources). Firms that adopt these principles must pledge to reduce waste, conserve energy, and market environmentally safe products. A similar strategy is being used to encourage businesses investing in South Africa to promote racial equality. Other economically based strategies that promote social change include boycotts (Nestle's, non-union grapes, tuna) and divestment (South Africa, nuclear power, tobacco) as well as programs promoting the products of socially conscious firms (Co-Op America). Have students form teams to research case studies involving economically oriented strategies. What factors contribute to the success or failure of these strategies? To what extent can similar strategies be applied to the environmental movement? Ask students to choose an issue and plan a hypothetical campaign using some of the same strategies.

5 Students can explore the balance between environmental protection and economic growth by developing a series of guidelines for biomass replacement in their community. Have students play the roles of developers and conservationists to negotiate a series of regulations to ensure that new projects that will increase pollution – by increasing traffic, for example – will take steps to make up for it – by planting trees or providing transportation alternatives. How many trees will be needed to absorb the additional carbon dioxide emitted by each car? (The average car emits 20 pounds of carbon dioxide for every gallon of gas consumed. According to the Sierra Club, one tree can absorb 26 pounds of carbon dioxide per year. Conversely, Renew America, another environmental organization, says that one acre of trees absorbs four tons of carbon per year.). Other recommendations might include setting aside an area of park land equivalent to the amount of open space being built on; planting a tree for every one cut down; constructing housing for employees nearby to reduce pollution generated by commuters; providing shuttle service for commuters; or encouraging car pools. Students can present their package of recommendations to the local planning board.

6 Find out what your community is breathing. Line a bucket with plastic, fill it halfway with water, and put it on a roof or someplace where it won't be disturbed. Leave it for a few weeks. Then filter the water through paper. After the paper dries, use a microscope to identify the particles. Compare results with students doing similar experiments at schools in other towns or countries (for telecommunications networks, see Resources).

Questions to Consider

- Should the price of gas include the cost of cleaning up pollution?
- Should we cut down on the mining and burning of coal even if thousands of people lose their jobs?
- How could you change your own lifestyle to minimize waste, pollution, and energy consumption? How much would you be willing to do?

nitrogen oxides A class of air pollutants that is a key ingredient in both smog and acid rain. Nitrogen oxides are usually formed by the burning of gasoline and other transportation fuels.

point source A specific location, such as a sewage treatment plant, where contaminants are released into a body of water. A nonpoint source of water pollution is one that cannot be localized to a single point, such as runoff from fertilized fields near a river.

primary pollutant A contaminant that enters the air or water directly. A secondary pollutant is produced when air or water interacts with primary pollutants, such as smog and eutrophication.

smog A brown haze of pollutants formed in the presence of sunlight by reactions between the hydrocarbons and nitrogen oxides released by industries and motor vehicles.

Recommended Readings

Maurits la Rivière, J. W. "Threats to the World's Water." *Scientific American* 261 (September 1989).

National Academy of Sciences. *Air Pollution, the Automobile, and Human Health*. Washington, D.C.: National Academy Press, 1988.

Postel, Sandra. "Protecting Forests from Air Pollution and Acid Rain." In *State of the World 1985*, by Lester R. Brown et al. New York: W. W. Norton & Co., 1985.

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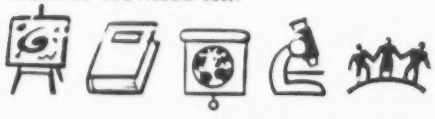
Development

Overview

Two-thirds of the world's population lives in poverty. Around the globe, poor nations are struggling to improve their lots through economic development. All too often, however, projects modeled on Western-style development have had disastrous consequences: the depletion of irreplaceable natural resources, the degradation of the environment, and the displacement of individuals and communities.

Activities

1 Students can correspond with their peers in third-world countries to exchange observations, the results of experiments, and views on environmental issues. The Peace Corps' World Wise Schools Program allows teachers and students to exchange materials such as slides and artwork. Telecommunications networks such as TERC and EcoNet can also be used to interact with classes in other countries (see Resources).



Questions to Consider

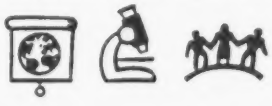
What is an advanced society? Is it one that has learned to live with the environment or one that tries to control it? Is industrialization self-destructive?

Should we care about waste disposal and sanitation in developing countries? Why or why not?

Should American companies working in foreign countries be required to follow the same environmental regulations as they would in the United States, even if the host nation has no such regulations?

2 Have students research rain forests and prepare diagrams illustrating how they process sunlight, water, and nutrients. How do temperature and humidity affect the rain forest? Why is it able to sustain so many species? Mark areas of rain forest on a world map. Who is deforesting the rain forest and why? Why isn't deforested land able to support agricultural practices such as cattle ranching and farming in the long term?

Have students create a display of items that link their lives to the rain forest or to the industries that have depleted it. Such items include medicines; wood products made from mahogany, teak, or rosewood; Brazil nuts; cocoa; bananas; tin cans; rubber; and hamburgers made from South American beef. Note which items can be produced or harvested without harming the rain forest while providing an economic benefit for the people who live there. For items which lead to rain forest destruction, have students suggest ways to replace or avoid using them. Students may want to devise a fund-raising campaign to help save the rain forest. Possibilities include collecting recyclable bottles or selling Rain Forest Crunch candy (from Cultural Survival, Inc.) and donating the proceeds to conservation groups. (For more information, see Resources.)



3 Many third-world countries are struggling to repay loans from banks in industrialized countries. The third-world debt crisis poses more than an economic threat to parties on both sides of the balance sheet. Demand for foreign exchange forces third-world countries to engage in unsustainable development strategies focusing on the export of raw materials. Have students research the debt crisis and examine statistics on imports and exports for selected third-world countries. To what extent have the demands of industrialized countries influenced the development patterns of third-world countries (e.g., extracting mineral resources to support manufacturing, importing non-food agricultural products such as coffee and tobacco)? Why should debtor nations forgo a standard of living similar to ours in order to protect the environment, especially when industrialized countries continue to pollute and deforest? Some banks have proposed swapping debt payments for environmental concessions. Who benefits most from such an arrangement? For an interesting case study, research The Nature Conservancy's debt-for-nature swap in Costa Rica (see Resources).

Key Words

development The economic and social process by which a nation seeks to improve the standard of living of its people. The precise methods for promoting economic growth and diversification depend on the goals a particular society sets for itself.

external debt The money borrowed from foreign creditors to pay for projects related to development. It must be repaid in the currency of the country from which it was borrowed. To repay the loan, the developing country must export goods to the lending country, often at the cost of not being able to provide goods for its own people.

sustainable development A strategy that emphasizes protecting the environmental resources that generate economic development, so that meeting the needs of current generations will not compromise the ability of future generations to meet theirs.

World Bank The International Bank for Reconstruction and Development, a multinational bank, created to finance the reconstruction of Europe after World War II. The World Bank has invested in many third-world development projects. Environmentalists have criticized a number of its projects for destroying irreplaceable natural resources. The bank is in the process of strengthening its attention to environmental concerns.

Rising population levels in many countries threaten the economic gains of development and put new pressures on the environment. In Brazil, for example, efforts to ease urban overcrowding and poverty by resettling poor families in the Amazon river basin have contributed to the destruction of the rain forest. Since the rain forest plays a critical role in soaking up the world's carbon dioxide emissions, the implications are urgent for everyone. If the Brazilian rain forest continues to be destroyed at today's rate, it will be gone in 30 years.

In Brazil and other countries, grass-roots movements are questioning whether large-scale industrialization is the only path to prosperity. Emphasis is being placed on community-based strategies for environmentally sustainable development, making the protection of natural resources the basis for more equitable economic growth.

Program Synopsis

Episode 4: *In the Name of Progress*

This episode investigates the consequences of Western-style industrial development in India and Brazil. Economists and environmentalists express a variety of views on the tensions between economic growth and environmental protection. Profiles of local grass-roots movements, namely India's Chipko movement and the Brazilian rubber-tappers' union movement, offer examples of alternative development strategies.

4 The destruction of rain forests is happening here in the United States, not just in third-world countries. Have students identify Alaska's Tongass National Forest on a map and prepare a case study of its destruction. How does the Tongass rain forest differ from tropical rain forests? How much of the forest has been cut down and why? Who benefits and who loses? What are the trade-offs between creating jobs and preserving the environment? What steps is Congress taking to protect the Tongass rain forest? For information about the Tongass Timber Reform Act, students may contact Senators William S. Cohen (322 Hart Senate Bldg., Washington, D.C. 20510) or George Mitchell (176 Russell Senate Bldg., Washington, D.C. 20510).

5 Deforestation is a problem in temperate forests as well as rain forests. Have students brainstorm some of the consequences of deforestation in both types of forest, including soil erosion, cycles of drought and flooding, and reductions in fuel wood. Have students name some of the causes of deforestation: dams, mining, lumbering, and fuel wood gathering are some examples. Research the logging and paper industries. Can we continue to meet our needs for paper and wood products without destroying forests? What pressures encourage the overharvesting of trees? How can companies be encouraged to protect the environment? What steps have various environmental groups taken to pressure them to do so? As a case study, have students research the current controversy over the management of forests in the Pacific Northwest. Should economic considerations be taken into account when designating endangered species (in this case the northern spotted owl)?

6 Have students research and present case studies of development projects that incur high social and environmental costs. Some examples are livestock development in Botswana, transmigration in Indonesia, the use of pesticides in the Sudan, the Carajas iron ore project in Brazil, or the Sardar Sarovar dam in India. Why did the governments of these countries embark on these projects? What have been the positive effects? To what extent were negative consequences unforeseen or underestimated and why? What role did Western countries play in providing aid for these projects or a market for the goods produced?

Also have students look at development projects that successfully balance economic development and environmental protection. Examples are the Kenyan Green Belt movement, the Majjia Valley windbreaks in Niger, and the establishment of extractive reserves in the Brazilian rain forest. What economic and environmental factors account for the success of these projects? What can people in industrialized countries learn from these projects?

Tapping rubber trees in the Brazilian rain forest allows the inhabitants to survive without destroying the forest.

Recommended Readings

Brown, Lester R. *Building a Sustainable Society*. New York: W. W. Norton & Co., 1981.

Callahan, Daniel. "Ethics and Population Limitation." *Science* 175 (1972): 487-494.

Fornos, Werner. *Gaining People, Losing Ground: A Blueprint for Stabilizing World Population*. Washington, D.C.: Population Institute, 1987.

Friends of the Earth. *Financing Ecological Destruction: The World Bank and the International Monetary Fund*. Washington, D.C.: Friends of the Earth, 1988.

Hartmann, Betsy. *Reproductive Rights and Wrongs: The Global Politics of Population Control and Contraceptive Choice*. New York: Harper & Row, 1987.

MacNeill, Jim. "Strategies for Sustainable Economic Development." *Scientific American* 261 (September 1989): 154-165.

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Wilderness

Overview

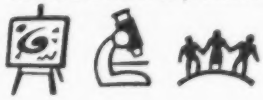
The loss of biological diversity poses an unprecedented crisis for our planet. In a single lifetime, more than half the species on earth are in danger of being lost forever due to the destruction of the rain forests alone. The loss of genetic diversity among species makes those that survive more vulnerable to diseases and other disasters.

Activities

1 To illustrate the diversity of different environments, have students perform an inventory of the species they can collect or observe in an area of one square meter. Teams of students can investigate different settings: an urban park, a nature reserve, the school grounds, a pond or stream, an area of true wilderness, or a city sidewalk. Have them prepare a display of their findings and compare results.

2 To illustrate the ways that lack of genetic diversity decreases the resilience of a species, have students research the effects of inbreeding on domesticated animals such as dogs or racehorses. Divide the students into groups to study species threatened by a limited gene pool, such as cheetahs or Pacific coast sea lions, and have them present their findings. Students can also make murals, paintings, and posters encouraging action to help protect endangered species.

3 The vast majority of the earth's species are invertebrates. Without insects, life on the planet would revert to algae soup within a few decades. Yet the endangerment of invertebrate species, a critical consequence of deforestation, does not seize the popular imagination the way endangerment of baby seals does. Have students research the role of invertebrates in the ecosystem, then hold a competition among teams of students to see which team can develop the best ad campaign, using posters, radio jingles, and print or television ads to heighten public awareness about the need to protect invertebrate life.



Giraffes munch hay in a new veldt exhibit at the Phoenix Zoo.

Key Words

biological diversity The full array of living species on the earth, including genetic variations within each species.

captive breeding Breeding endangered wild animals in zoos in the hope of increasing their number. Only some wild animals have been bred successfully in zoos.

ecosystem A community of plant and animal species and its physical and chemical environment.

The richness and diversity of life forms is one of our least recognized natural resources. For example, relatively few of the millions of Amazonian plant species have been evaluated for medicinal uses, yet 70 percent of new cancer drugs are made from plants native to tropical rain forests. While you are reading these words, a plant species that could cure some type of cancer may be wiped out forever.

Protecting biodiversity goes beyond preserving individual endangered species. The very web of life is fraying. Only by taking active steps to restore damaged ecosystems and to balance our needs with those of other species can we hope to reverse the slide toward extinction that threatens the stability and resilience of life on earth.

Program Synopsis

Episode 5: Remnants of Eden

Opening in the rain forest, this program explores the richness and interdependence of the planet's life forms and stresses the critical role of habitat restoration in preserving species. Ecologists guide viewers through conservation projects in Kenya, Thailand, the U.S., and Costa Rica. The episode details the impact of human activity on biological diversity, and evaluates strategies to protect wild species and their ecosystems.

4 To help students grasp how various species interrelate in a given environment, have them choose an area in one of several climate zones and diagram a simplified ecosystem characteristic of that zone. They can start by describing the topography and listing the plant, animal, and invertebrate species. Then ask them to show as many relationships as possible linking the different species. What would happen if one of the species disappeared?

Questions to Consider

What responsibilities do we have to other species? Do other species have an inherent right to exist or should we protect only those that we think we need to survive?

Are efforts to protect endangered plant and insect species as important as those that protect large animals such as pandas and elephants? Why or why not?

Do you agree with the statement by Harvard University's Edward O. Wilson that human activities that destroy wild habitats and hasten the extinction of species are equivalent to "burning Renaissance paintings to cook dinner"?

5 A number of books discuss or illustrate society's relationship to nature, including the classic writings of John Muir (such as *The Mountains of California, Our National Parks,* and *My First Summer in the Sierras); The End of Nature* by Bill McKibben (New York: Random House, 1990); *The Control of Nature* by John McPhee (New York: Farrar, Straus & Giroux, 1989); and *The Man Who Planted Trees* by Jean Giono (Chelsea, VT: Chelsea Green Pub. Co., 1985). Ask students to read one of these books and present a brief report. An Oscar-winning animated version of *The Man Who Planted Trees*, about a man who single-handedly plants a forest in southern France, is available in English or French from Direct Cinema, P.O. Box 69799, Los Angeles, CA 90069; (213) 652-8000.

6 The common description of wilderness as untamed implies that we view ourselves as potential tamers, standing outside of nature and acting on it. Some critics argue that our culture's separation from and fear of nature derives from the Judeo-Christian rejection of polytheism and paganism. Have students look at a less human-centered view of nature by researching and acting out the myths and folktales of other traditions – Native American, ancient Greek, Balinese, African, Druid, ancient Egyptian, or Taoist. Ask each to prepare a mask, costume, or poster relevant to a particular story and use it to dramatize or tell the story. Discuss how different cultures and religions envision the human relationship with other species and with nature as a whole.

extinction The irreversible eradication of a species, caused by the inability to reproduce, which results from a reduction in numbers or the destruction of its habitat. Species originate only once.

food chain The sequence of relationships in an ecological community that shows who eats whom. Food chains are connected to each other in food webs, the complex of interrelated food chains in a community.

habitat The place or ecosystem in which a species is found.

restoration The attempt to reestablish all the original species of an ecosystem that has been damaged by human activity.

Recommended Readings

Ehrlich, Paul R. *The Machinery of Nature*. New York: Simon and Schuster, 1986.

May, Robert M. "How Many Species Are There on Earth?" *Science* (September 1988): 1441-49.

Myers, Norman. *The Primary Source: Tropical Forests and Our Future*. New York: W. W. Norton & Co., 1984.

Wilson, E. O. *Biodiversity*. Washington, D.C.: National Academy Press, 1987.

Wolf, Edward C. "Conserving Biological Diversity." In *State of the World 1985*, by Lester R. Brown et al. New York: W. W. Norton & Co., 1985.

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Energy

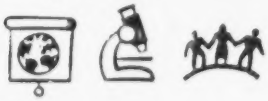
Overview

Over the past 150 years, our society has become addicted to fossil fuels – a dependence that is poisoning our planet. As the threat of global warming looms, the question is not how long these resources will last, but how long we can afford to continue using them at the present rate.

Since it can take up to 40 or 50 years to change from one energy source to another,

Activities

1 To assess the relative advantages and disadvantages of different sources of energy, have students draw up a wall chart with a column each for the supply, use, cost, technological accessibility, and environmental impacts of a given energy resource. Then have groups of students research different energy sources, both nonrenewable (oil, coal, nuclear) and renewable (solar, tidal, biogas, geothermal, wood, large- and small-scale hydropower). Make sure they consider all aspects of a technology; for instance, solar energy requires the mining of copper for tubing. What choices make the most sense for the short term? For the long term? To what extent do our choices for the long term depend on choices in the short term? What new technologies will we need to develop to assure a broad range of choices for the future? Have students break into teams representing different areas of the world, and ask them to research the energy sources, concerns, and energy-related environmental problems relating to that area. Then have them try to reach a consensus on a global energy strategy.



2 Show how energy efficiency could reduce global warming by having students calculate the relationship between gas mileage and carbon dioxide emissions in automobiles. For every gallon of gas consumed, a car emits 20 pounds of carbon dioxide; the average car on the road today gets 18 miles per gallon (mpg) and emits 5 tons of carbon dioxide per year. How much carbon dioxide would a car getting 15, 25, 35, or 50 mpg emit in one year? Compare the savings in carbon dioxide and money. Why hasn't the government imposed tougher fuel-efficiency standards?

Several major automakers have produced prototype cars getting between 67 and 138 mpg. One prototype is the Volvo LCP 2000, which gets nearly 100 mpg while meeting safety, performance, and emissions standards. Students can research similar efforts by Volkswagen, Chevrolet/Suzuki, Toyota, Peugeot, and Renault. Why don't automakers produce these cars for the mass market? What government policies might make these cars more marketable? What would be the impact be on the oil and automotive industries?

3 Students can make the connection between energy sources and lifestyles by diagramming or building models of energy-efficient homes. Some should focus on existing housing, showing ways of using alternative sources of energy and of making current sources more efficient. Others should design solar or earth-sheltered homes, demonstrating ways to capture the energy resources of a particular setting or climate. How will water and space be heated or cooled? How will energy be stored? What household appliances will be needed and how will they run? What will be the principal sources of light? What lifestyle changes would accompany changes in housing design? How fast do you think our society would adapt to these changes?

Key Words

biogas An alternative energy source generated from manure that can be used for cooking or space heating.

compact fluorescent light bulb A bulb that provides as much light as an incandescent bulb while using only a fraction of the electricity.

high-temperature gas-cooled reactor A small-scale nuclear reactor using helium gas as a coolant instead of water, a feature that is supposed to eliminate the risk of a meltdown.

photovoltaic (PV) cell A cell that converts sunlight into electric current. Already used at remote installations such as satellites and to power small electronic devices such as calculators, PVs are expected to compete with large-scale sources of power.

...e must begin planning now for the transi-...n to a sustainable energy strategy. Energy ...nservation is our most abundant and lowest ...sting strategy: by reducing demand and ...creasing efficiency, we could reduce energy ...nsumption by at least 50 percent in every ...ector of the economy and avoid the worst ...ffects of global warming. Scientists are also ...designing new technologies to minimize the ...environmental impact of coal-burning, wood-...burning, and nuclear energy sources.

...truly comprehensive and sustainable ...nergy strategy, however, must involve the ...se of renewable energy resources, such as ...wind, water, biomass, and solar power, ...hrough technologies now being pioneered in ...developing as well as industrialized countries. ...Together these efforts will lay the foundation ...for an energy strategy that is affordable, ...politically acceptable, and safe for the ...environment.

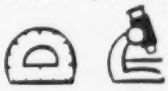
Program Synopsis

Episode 6, *More for Less*

This episode profiles efforts to move away from dependence on conventional energy sources. It shows how utilities and industries in the United States and Brazil are saving money and energy through dramatic improvements in energy efficiency, and examines new technologies for making coal cleaner and nuclear power safer. Finally, it investigates renewable energy programs in Denmark and India.

4 Some scientists say that because of global warming, an energy strategy based on nuclear power is our best choice for the future. Ask students to do some research on nuclear power and to decide whether they agree or disagree. Split the class into groups to make presentations about different aspects of nuclear power. Possible topics include a study of nuclear power in France or Sweden, a report on the accidents at Three Mile Island and Chernobyl, a discussion of so-called safe nuclear technologies, and an investigation of nuclear waste disposal. What environmental or other problems does nuclear power pose? How do these problems compare to those that may be caused by the continued use of traditional energy sources? How do students assess the relative costs and benefits of nuclear power?

5 By translating the language of energy into their own experience, students can see how much human work is saved by the use of high-quality energy sources and how little people could accomplish without them. Time several students as each runs up a set of stairs. By multiplying the height of the stairs by the student's weight and dividing by the time it took to run up, each student can calculate his or her personal horsepower. (1 horsepower equals 550 foot-pounds per second.) Convert this number into watts to see how many times a student would have to run up and down to power a light bulb or a stereo for an hour. (1 horsepower equals 746 watts.) To get the value in metric terms, measure the height of the stairs in meters and the student's weight in newtons (4.5 times the number of pounds). Multiply the two together to get the number of joules. (1 watt equals 1 joule per second.)



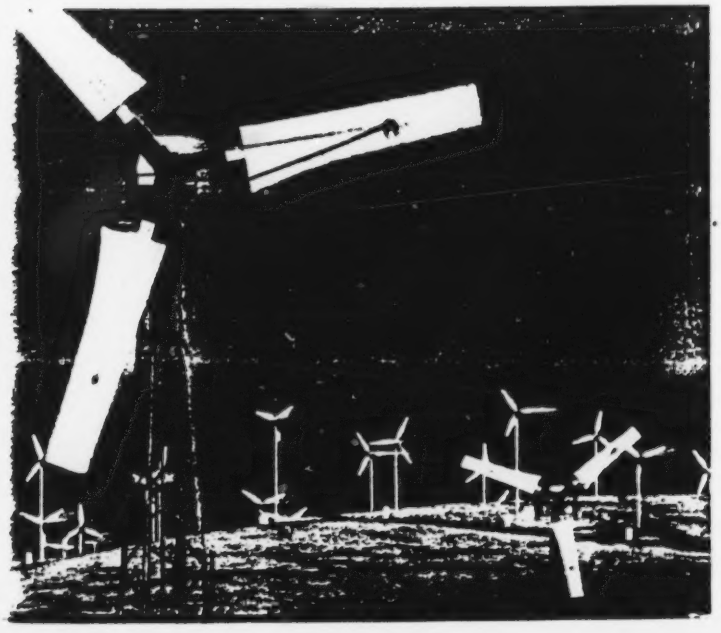
6 As an example of how politics, economics, and technology converge, have students research the oil crises of 1973 and 1979 by reading newspapers, interviewing parents, and researching annual statistics on energy use. What were some of the causes of the dramatic rise in oil prices? How did it affect other sectors of the economy? How did the car industry, public utilities, and consumers respond? What were some of the political consequences? How do oil prices shape energy strategy and consumer choices?

Q ...

Some of the world's worst environmental disasters are the result of failures of conventional energy technologies; for example, the nuclear explosion at Chernobyl and the Exxon Valdez oil spill. Who should be held accountable: 1) the people directly responsible, 2) the institutions that operate the equipment, or 3) the societies whose energy needs require the existence of conventional energy systems?

What would you do if a nuclear power plant was built in your neighborhood? Where should nuclear power plants be built?

...ng farming, a ...ple example of ...newable energy source.



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Agriculture

Overview

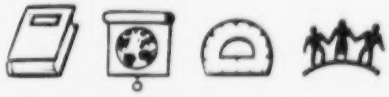
At a time when the population of the world is increasing exponentially, our ability to produce food appears to have reached its peak. Between 1950 and 1984, world grain output more than doubled and the amount of grain per person increased by 40 percent. Since then, however, per capita grain production has dropped by 14 percent. The intensive use of chemical fertilizers, pesticides,

Activities

1 Increases in grain production over the past 40 years are attributable primarily to the use of chemical fertilizers. To demonstrate the effectiveness of chemical fertilizers in promoting growth, have students grow tomatoes in soil, in compost, and hydroponically. Fertilize half the plants in each category with a chemical fertilizer such as Miracle-Gro. Students can keep a weekly journal in which they observe and compare the results. Which plant grew fastest and strongest and bore the most fruit? Which cost the most to grow? To what extent do increased yields offset increased costs?

Take students to visit nearby conventional or organic farms and talk with farmers. What changes in farming practices, such as the rise in monocrop farming, have encouraged farmers to turn to chemical fertilizers? What traditional fertilizers might be substituted for chemicals, and what are their relative advantages and disadvantages? What are other avenues that farmers and scientists might pursue to increase productivity? How do the costs and practices of organic farming compare to those of conventional farming?

2 Assign Thomas Malthus' 1798 essay, "On Population Growth" (New York: Cambridge University Press, 1989, or New York: W. W. Norton & Co., 1976) along with writings by cornucopians (such as *The Ultimate Resource* by Julian Simon, Princeton, N.J.: Princeton University Press, 1981). Have students prepare graphs showing changes in world population and world food production over the past 40 years and have them compare different countries as well. Graph projections for future trends in population growth and food production. To what extent do these graphs support Malthus' hypothesis? To what extent do they validate Simon's view? How far can science go in offsetting the limitations of natural resources?



3 No one knows the long-term effects of pesticides on human health. Pesticide contamination may pose a serious health hazard to farm workers. It is also a significant threat to our nation's groundwater: one in every three counties is affected. Ask students to survey local supermarkets and compare the prices and availability of organic produce. Have them investigate the United Farm Workers' recent campaign to boycott table grapes grown with pesticides. Who was the boycott designed to protect? Ask them to brainstorm other ways that consumers might encourage farmers to minimize the use of pesticides and fungicides (purchasing less-than-perfect produce or only buying in season, for example). Why are prices for organically grown produce higher? How could prices be made to reflect the environmental costs of using pesticides?

The Naam movement in sub-Saharan Africa fosters community work to promote more abundant crops and "give out hunger – faim."

Key Words

agrochemical A pesticide or fertilizer used to maximize crop yields. Agrochemicals cause serious environmental problems, ranging from groundwater contamination to soil depletion.

crop rotation The traditional practice of planting a cycle of different crops in the same field in order to maintain the fertility of the soil and limit the growth of pest populations.

Green Revolution The introduction of high-yield, high-input farming technology into some third-world countries during the 1960s and 1970s. Variations in environmental and economic conditions accounted for the program's uneven results.

integrated pest management (IPM) A combination of biological, mechanical, and chemical pest-control methods that allow farmers to minimize the damage caused by crop pests.

irrigation, and mechanization has reached the point of diminishing returns.

The transformation of agriculture threatens to convert our soil into a nonrenewable resource. Changing agricultural practices in industrial and developing countries have accelerated environmental problems such as erosion, salinization, and the chemical contamination of soils and groundwater. The prospect of widespread drought caused by global warming poses further danger to the world's topsoil.

We must find ways of increasing agricultural productivity without sacrificing sustainability. By combining traditional, ecologically sound practices with new scientific insights, farmers around the world can ensure that future generations will inherit a planet capable of producing food for their children.

Program Synopsis

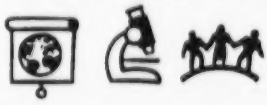
Episode 7: *Save the Earth – Feeding the World*

[illegible] sustainable agriculture. It examines the environmental impact of industrialized agriculture in the U.S. and Australia, then travels to Indonesia and West Africa for a look at alternative methods of pest management and soil conservation. The episode concludes by evaluating the potential role of biotechnology in resolving the conflict between agricultural productivity and sustainability.

4 Erosion is one of the most significant problems in maintaining sustainable agriculture. Approximately seven percent of the world's topsoil disappears each decade. In farming regions of the United States, topsoil is swept away by wind or water at 18 to 100 times the natural rate of replacement. Explain the three major types of erosion by water – sheet, rill, and gully – and discuss some of the causes and consequences of each. Have students research traditional ways of minimizing erosion, such as terracing or alley cropping. Then locate an area of erosion in your community and identify the human activity that caused it: deforestation, plowing, stripping the topsoil for sale, poor drainage, and so on. Ask students to devise a plan to protect the remaining soil.

5 The Dust Bowl of the 1930s was the most dramatic example of wind-based erosion in U.S. history. Its ramifications were cultural as well as environmental. Have students read John Steinbeck's *The Grapes of Wrath* (New York: Viking, 1989) and create a multidisciplinary multimedia exhibit on the Dust Bowl. Activities might include preparing displays that focus on the scientific aspects of wind-based erosion, researching the role played by drought and crop changes in causing massive erosion, and making dioramas showing changes in the area's ecosystem over time. Students may choose to focus on history, performing readings from contemporary accounts, oral histories, and news stories from affected states – including those thousands of miles away where some of the soil was blown. A bulletin-board display could focus on the economics of displacement, comparing contemporary news clippings with more recent ones on the farm crisis of the late 1980s. Other students can perform or tape songs from the Dust Bowl or create a display of WPA photographs documenting displaced farmers' experiences.

6 Agriculture involves reducing the diversity of a given ecosystem and therefore must be heavily controlled in order for the system to remain stable. Have students form groups to build models of farms using traditional methods of agriculture, such as slash-and-burn, African intercropping, Indonesian intensive home-gardening, or preindustrial European farming. Each group can present a brief oral report describing how farmers take advantage of the local ecosystem as well as the conditions on which the sustainability of food production depend. Then have each discuss what happens when these conditions are no longer met and what pressures have forced farmers to abandon traditional methods or overstress resources.



Questions to Consider

Does your family use a water filter or buy bottled water? Why? Should we be able to expect that the water that comes out of the tap is safe to drink?

Would you be willing to pay more for food in order to insure that more sustainable agricultural practices were being used?

low-input agriculture Farming methods that minimize reliance on fertilizers, pesticides, and other commercial inputs.

organic farming A low-input farming method that relies on natural fertilizers and methods of pest control.

salinization The poisoning of topsoil by salt evaporated from water used for irrigation.

Recommended Readings

Brown, Lester R. "Conserving Soils." In *State of the World 1984*, by Lester R. Brown et al. New York: W. W. Norton & Co., 1984.

Douglass, Gordon K., ed. *Agricultural Sustainability in a Changing World Order*. Boulder, Colo.: Westview Press, 1984.

Eisenberg, Evan. "Back to Eden." *The Atlantic* (November 1989).

Gips, Terry. *Breaking the Pesticide Habit*. Minneapolis: International Alliance for Sustainable Agriculture, 1987.

Jackson, Wes, Wendell Berry, and Bruce Colman. *Meeting the Expectations of the Land: Essays in Sustainable Agriculture and Stewardship*. San Francisco: North Point Press, 1984.

Phipps, Tim T., Pierre R. Crosson, and Kent A. Price, eds. *Agriculture and the Environment*. Washington, D.C.: Resources for the Future, 1986.

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Waste

Overview

In nature, materials are endlessly exchanged among living and nonliving systems. Only humans create waste by failing to complete this cycle of transformation and reuse. The more affluent our society, the less incentive we have to recognize and conserve waste as a potential resource.

In the United States, each person generates about a ton of garbage each year, two to five times as much as a person in any other industrialized country. Established methods

Activities

1 To help students visualize the volume of garbage they generate, have each student collect all the garbage he or she would throw out in one week. Have them separate their trash into categories (paper, plastic, organic waste, etc.) and bring it into the classroom to measure the weight and volume of each. How much of this waste could be recycled? Add up the amounts generated by the class as a whole and ask students to figure out how much garbage their whole grade or school would generate in a month, a year, or a decade. Have them make a chart showing these projections. Encourage the use of visual images to convey the amount of space this volume of garbage would occupy (truckloads, swimming pools, baseball stadiums, for example).

2 Many potentially reusable items are designed to be disposable. Have students go through their homes and take an inventory of all the disposable items there. Find reusable substitutes for as many of these as possible and create a display pairing the items. Consider taking a field trip to a supermarket to see how many disposable items are available. Discuss the energy costs, resource depletion, waste, and pollution involved in throwaways and compare them to the costs of reusable items. Why does our society put such a premium on disposables? What are the benefits and drawbacks of reusable items? Which costs more money in the long run? How would a return to reusable items alter our lifestyles? Students can ask their parents and grandparents to recall what life was like before so many items were disposable.

3 If your school is equipped to handle liquid chemical waste, give students hands-on experience trying to clean up an oil spill. Pack one side of a plastic tub with wet sand and rocks to make a sloped, artificial beach, and fill the rest with water. Pour some motor oil (or cooking oil) on the water and make some waves to spread it. Have students dip in a finger, then a feather, and record their observations. Put a hard-boiled egg in the oil for 10 minutes and another one in for 20 minutes, then peel them to see how much oil they have absorbed. Ask students to try various methods to clean up the spill, such as adding detergent or blocking it with popsicle-stick "floats." How well do these methods work? What happens when the oil reaches the beach? How might an oil spill affect furred or feathered wildlife? How might it affect industries such as tourism or fishing?

Greenpeace uses a New York City garbage barge to make its point.

Key Words

incinerator A specially constructed combustion chamber used to burn solid waste at high temperatures. Incineration reduces the volume of waste by about 75 percent, but leaves a residue of toxic ash that is usually buried in a landfill. Fumes from incinerators can also pollute the air.

landfill A dump where wastes are buried. Some landfills are simply open pits; others are carefully engineered to encourage degradation, siphon off methane emissions, or prevent wastes from leaking into the groundwater. Methane from landfills can be used to generate heat.

for solid-waste disposal have reached their limits – almost half of our towns and cities are within five years of exhausting their landfills – while the disposal of sewage and toxic wastes threatens to contaminate land and groundwater supplies alike.

Simple steps can be taken to reduce the amount of garbage we generate. For example, packaging makes up about half the trash we throw out, but much of it could simply be eliminated. The largest component of solid waste is paper which is potentially recyclable. Nonrecyclable plastics, another significant component, represent a poor use of petrochemical resources since in many cases recyclable substitutes, such as glass and paper, are available. By redefining waste as a resource worth conserving, we can restore our place in the natural metabolism of the planet.

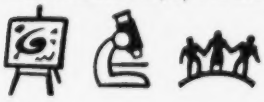
Program Synopsis

Episode 8: Waste Not, Want Not

[illegible] to the problem of waste. It explores how to reduce waste at the source, solid waste management and recycling in Japan, the Danish model of toxic-waste disposal, and the use of low tech methods to treat human sewage in California [illegible] ways to recover, reuse, or recycle garbage. It encourages viewers to question the cultural assumptions that govern our definition of waste.

4 Roughly half of all household waste is made up of packaging. Have students bring in examples of heavily packaged goods (e.g., a compact disc) and goods whose packaging is environmentally sound (e.g., an ice cream cone). Ask them to list some of the functions of packaging: protecting the product or the consumer, providing advertising, preventing theft, promoting convenience, minimizing product damage and spoilage, and making the product appear larger. Then challenge students to design new, environmentally appropriate packages for products they brought in and send their designs to the manufacturer.

Which kinds of problems justify packaging? Have students come up with ideas about how we can cut down on packaging-related waste (e.g., by buying large sizes of products instead of a lot of small ones, by refusing to buy heavily packaged items and informing manufacturers of this decision, by praising manufacturers' shifts to more environmentally sound packaging). Discuss the pros and cons of a tax on non-recyclable packaging (manufacturers would pay a tax on packaging that was not recyclable). Who would benefit and who would pay the costs?



5 How does your community deal with its trash? Have students trace where their household trash goes by traveling to the landfill and/or incinerator site that serves their community; investigating how sewage is treated and disposed; visiting a recycling center or material recovery facility, if there is one; and attending a household toxic-waste pickup day. Have them prepare a flowchart showing where the waste generated by a typical household goes. Then have them prepare another chart showing how that waste might be recycled or more safely disposed of. Students can also make a display that tells how long a given piece of waste persists in a landfill (i.e., nylon stockings, aluminum cans, styrofoam). Design a program to encourage waste reduction in your town (e.g., by paying for trash removal by weight, instituting curbside recycling, or designing a public-relations campaign). Invite a local sanitation official to discuss the problems facing the community, such as limited landfill space or rising costs, and to review the environmental advantages or disadvantages of the town's solid-waste disposal strategy.

6 Have students form groups to investigate in-depth some of the topical controversies concerning solid or toxic waste. Some examples are the use of cloth versus disposable diapers, the marketing of biodegradable or photodegradable plastics, the presence of dioxin in paper products (the largest category of solid waste), or the proposed methods for disposing of nuclear wastes. Have each group prepare a chart listing the pros and cons of each side and post the chart on a bulletin board along with clippings relating to both sides of the issues.

Questions to Consider

What do people mean when they say there is no "away" (as in throwing away)? Do you agree or disagree?

Is it all right to dump hazardous waste in countries with less strict dumping laws? Whose responsibility is it to protect the people and the environment in other countries?

Would you buy recycled paper even though it's more expensive, or would you wait for the price to come down? If everyone bought recycled paper, what would happen to the price?

leachate The liquid that seeps downward from a landfill. Often laden with chemical or biological contaminants, leachate poses an important threat to groundwater supplies.

sewage treatment A three-stage process of filtering, decomposing, and purifying human waste to prevent it from contaminating water supplies. Conventional methods produce liquid effluent and sludge that can be used as fertilizer or dumped in landfills.

toxic waste Material that poses health risks to humans and the environment. Both industrial and household refuse contain toxic products that must be treated before they can be disposed of safely.

Recommended Readings

Environmental Protection Agency. *Solid Waste Disposal in the United States*. Washington, D.C.: Government Printing Office, 1989.

Hamrin, Robert B. *A Renewable Resource Economy*. New York: Praeger, 1983.

Institute for Local Self Reliance. *Recycling Goals and Strategies*. Washington, D.C.: Institute for Local Self Reliance, 1988.

Neal, Homer A., and J. R. Schubel. *Solid Waste Management and the Environment: The Mounting Garbage and Trash Crisis*. Englewood Cliffs, N.J.: Prentice Hall, 1987.

Patrick, R., E. Ford, and J. Quarles, eds. *Groundwater Contamination in the United States*. Philadelphia: University of Pennsylvania Press, 1987.

Pollock, Cynthia. *Mining Urban Wastes: The Potential for Recycling*. Washington, D.C.: The Worldwatch Institute, 1987.

Politics

Overview

In "The Tragedy of the Commons," human ecologist Garrett Hardin describes the dilemma of environmental politics: while some individuals derive immediate benefits from our affluent lifestyles, the costs are spread out among a much larger group and over a much longer period of time. Governments must balance individual interests against the common good and the short term against the long. The challenge facing

Activities

1 To help students understand how regional interests shape the political debate over environmental issues, have them make a chart showing which senators and representatives supported the Clean Air Act and which opposed it. Color in the results on a map. Why did politicians from the Ohio Valley oppose the legislation? Why did politicians in the Northeast tend to support it? How did politicians from your state vote and why? Why do some politicians who claim to support the environment sometimes vote against environmental legislation? (See Resources to order *The National Environmental Scorecard*, available through the League of Conservation Voters.)

2 To dramatize the difficulty of resolving international environmental issues, have students hold a model U.N. conference to negotiate an agreement for phasing out CFCs. Students can start by researching proposals aired at the London United Nations Environment Programme (UNEP) conference held in April 1990. Then they can team up to represent such countries as the United States, Australia, Japan, India, Brazil, China, and an Eastern and Western European nation. Have each team research the specific concerns of the country it represents – the need for refrigeration to improve people's standards of living, the absence of alternatives to CFCs for use as solvents in the semiconductor industry, or increased rates of skin cancer, for example. How can industrialized nations help developing nations meet their needs without increasing damage to the environment? What should each nation be willing to give up for the common good? How do domestic tensions and special interest groups make it difficult for national governments to take a strong stand?

3 One proposed solution to pollution is to give companies the right to emit a certain amount of pollutants. Those whose enterprises generate fewer emissions would be able to sell their "rights" to other companies that pollute more. This would force companies to bear the cost of pollution with minimal government intervention. Which industries would benefit from the rising cost of pollution and which would suffer? How would changes in the cost of pollution affect air quality? How would they affect the industrial base of the economy? Who would ultimately pay the cost? If the heavily polluting industries were concentrated in one part of the country, would air quality improve overall? How should we decide what levels of air pollution are acceptable?

Questions to Consider

Why are politicians less likely than individual citizens to lead environmental protection movements?

Should the government be allowed to exercise authority over those actions of private citizens that affect the environment, such as driving or household energy use?

Hundreds of thousands of people expressed their environmental concerns on the twentieth anniversary of Earth Day.

Key Words

Clean Air Act of 1970 Legislation that directed the EPA to identify major pollutants and establish national air-quality standards for them. The act reduced emissions of some major air pollutants but did not solve the problems of pollution dispersed high in the atmosphere, transported from one state to another, or generated by increased automobile use.

Clean Air Act of 1990 The first comprehensive overhaul of Clean Air legislation since the original act was passed in 1970. After heated debate between environmentalists and industry, Congress approved a compromise bill that addressed issues such as acid rain, auto emissions, smog, and toxic air pollutants.

environmental impact statement A document describing how a new law or project will affect the environment. Environmental impact statements are required for all government projects and legislation that will have a significant effect on the environment.

Environmental Protection Agency The U.S. government agency responsible for enforcing federal environmental laws, administering a "Superfund" to clean up toxic-waste sites, and awarding grants for local sewage-treatment plants. Laws governing the use of national forests, wilderness areas, wildlife refuges and other public lands are enforced by the Department of Agriculture and the Department of the Interior working through the Department of Justice.

National Environmental Policy Act Landmark legislation passed in 1969 declaring that the federal government has the responsibility to restore and maintain environmental quality.

political leaders today is not merely to balance competing interests but to establish environmental protection as an overriding interest on which the quality of life depends.

Global warming, acid rain, and deforestation all demonstrate that environmental problems transcend national boundaries. International polls show that a substantial number of people want to improve the quality of the environment, even at the cost of a reduced standard of living, personal sacrifice, and higher taxes.

Governments have the legislative and fiscal powers to mold individual choices so that individual interests coincide with the common good. Yet in most countries, the government agencies responsible for environmental protection are weak. Whether through action or inaction, today's governments will have a unique impact on the future of our planet.

Program Synopsis

Episode 9: It Needs Political Decisions

This program profiles government environmental policy in three countries. In socialist Zimbabwe, family planning is the centerpiece of the government's program to defeat rural poverty. Rapidly industrializing Thailand faces the twin challenges of deforestation and industrial pollution. Sweden's Environmental Ministry tackles environmental problems that are byproducts of affluence and have global impact.

4 The 20th anniversary of Earth Day 1970 was heralded with great fanfare. Have students compare the first Earth Day and its 20th anniversary by researching contemporary press accounts of each. Where did the impetus for each celebration come from? What issues were the focus? What organizations were involved? How was the day observed? Who were some of the speakers? Why was there so much more media involvement in 1990? How have the constituency, focus, and strategies of the environmental movement changed since 1970? What was the result of Earth Day 1970? Have students write an essay about what they think or hope will be the impact of Earth Day 1990. Has their awareness or behavior changed as a result of the celebration? To what extent have changes in the overall political climate affected changes in the environmental movement? Students may enjoy making a collage of images from the two events.

5 Acid rain is one of the most pressing environmental problems caused by industrial emissions. Political solutions are complicated by the fact that the regions where pollutants are emitted are different from those where acid deposition takes place. Have students break into teams to research and present reports on how different countries, such as the United States, Japan, Canada, Norway, Sweden, and the Soviet Union, are affected by acid rain, what the sources are, and what they are doing to stop it. What are citizens in each country most concerned about (damage to buildings, forests, or rivers and lakes)? What kinds of solutions have been proposed and who supports and opposes them? Why have some countries taken effective action while others are paralyzed?

6 Many students have only a vague idea of how laws are made. Have them make a flowchart of the legislative process for a recent state or federal law. Ask them to identify the following about the new legislation: the original impetus for it; how it was proposed; the role of committees in reviewing it and in formulating compromises on it; how lobbyists influenced the process; how final legislation was approved and funded; and which agencies are now involved in implementing and overseeing compliance with the new law. How did organized interest groups influence the outcome? How might the process be improved?

To understand the process on the local level, have students draw up a proposed ordinance, ask a sympathetic official or activist familiar with town government to help students refine their proposal, and plan a campaign to get it passed. Divide students into committees that will generate support through media relations, lobbying, grass-roots organizing, or fund-raising; then follow the proposal through the local legislative process.

Recommended Readings

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Clark, W. C. *Sustainable Development of the Biosphere*. New York: Cambridge University Press, 1986.

Durning, Alan B. *Action at the Grassroots: Fighting Poverty and Environmental Decline*. Washington, D.C.: Worldwatch Institute, 1989.

Kolko, Joyce. *Restructuring the World Economy*. New York: Pantheon, 1988.

Sargoff, Mark. *The Economy of the Earth: Philosophy, Law, and the Environment*. New York: Cambridge University Press, 1988.

Ward, Barbara. *Progress for a Small Planet*. New York: W. W. Norton & Co., 1979.

Sustainability

Overview

"If this planet were a patient," Worldwatch Institute director Lester Brown once said, "we would put it in intensive care." We have 30 to 50 years to restore its health, but to do so requires drastic changes, not only in our choices and behaviors, but also in our values and world view.

Changing our relationship with nature means changing our relationships with one another. The eradication of poverty may be

Activities

1 To give students a clearer appreciation of the challenge of sustainability, have the class build a terrarium biosphere and adjust it so that it is self-sufficient. Instruct students to diagram the food chain and food web. Then have them experiment with altering a single factor, such as removing one species or changing the temperature, and have them track the results. Students can follow up by designing a space station that would meet all their needs without generating any waste. Have each prepare a diagram showing how energy is generated and used, how food is grown, how material needs are met, and how waste is recycled. Have them research the Biosphere II closed ecosystem project being developed in Arizona's Sonora desert by Space Biospheres Ventures.

2 "Deep ecologists" stress the importance of developing a personal bond to nature as the basis for a commitment to environmentalism. How can students in an urban environment develop a relationship with nature? How has our relationship with nature changed since our grandparents' day? To what extent is our generation less environmentally conscious than they were? In what ways are we more attuned to the environment? Ask students to find a place in nature that they feel particularly close to (one near where they live or one that they only visit occasionally). Have them create an image of the place – a photograph or drawing, poem or song, diorama or collection of natural materials from it. Students can then talk briefly about the place, telling why they chose it and how it inspires them. Put the images together to create a display.

3 Environmental issues are often intertwined with issues of social justice. Both poverty and affluence pose threats to our environmental health, for example. Ask students to list ways in which their family's standard of living has improved over their lifetime. What new appliances or consumer goods do they own? (Running shoes, a VCR, a computer, an answering machine, or a second car.) Have them ask their parents and grandparents to make a list of items that they did not have in the home when they were growing up. On each list, have students circle the items that they would have the hardest time giving up. Which items are necessities and which are not? What makes them necessities? If these items are not available to everyone, should anyone own them? How can we ensure that the needs of the poor are met before we devote resources to luxury? Which of these items has a negative environmental impact?

A man stands on a soot-laden snowbank amid iron and steel mills in the Soviet Union.

Key Words

deep ecology An approach to environmental problems from the perspective of the planet as a whole, rather than from the perspective of a particular species such as humans.

Green Belt Movement A grass-roots tree-planting movement in Kenya. Begun in 1977, the movement supports community nurseries which issue tree seedlings to individuals, schools, and community groups, and raises public awareness about the problems caused by deforestation and soil erosion.

Mediterranean Action Plan An agreement among 17 countries to monitor and control pollution in the Mediterranean Sea. A milestone in international cooperation, the plan nonetheless has achieved only limited success in reducing pollution levels.

Montreal Ozone Agreement A 1987 agreement in which many countries pledged to halve production of CFCs and halons by the year 2000. The agreement has been amended, since most parties agree that the original schedule was too slow; most plan to phase out CFCs entirely by 2000.

one of the most important steps we can take to protect our planet's health. Similarly, cold-war tensions are fading and a new concept of common security may emerge, one based on the protection of global resources.

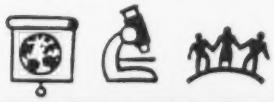
The rapid pace of environmental change requires a radical rethinking of our place in the natural and social environment. Instead of exploiting the world and one another for our own benefit, we must learn to "walk lightly on the earth," ensuring its ability to sustain us as well as all of the plant and animal species on which we depend.

Program Synopsis

Episode 10: *Now or Never*

The final episode focuses on ways individuals, communities, and nations are struggling to achieve sustainability, from the Green Belt reforestation movement in Kenya to the regional plan to clean up the Mediterranean Basin. Environmentalists and political leaders make a convincing case for the idea that environmental protection and economic growth must take place concurrently if the planet is to survive.

4 Some environmentalists consider rapid population growth the fundamental environmental problem, yet slowing it down raises unavoidable ethical conflicts. Part of the problem is that people have succeeded in controlling death rates far better than birth rates. Some deep ecologists even say that the human species, like any other, must be kept in check by natural forces, such as disease and famine. Ask students to respond to the proposition that the U.S. terminate medical and food aid to foreign countries. What would be the implications for population growth? Who would be affected most? Who should make the decision? If allowing death rates to rise is morally repugnant, what are the alternatives?



Questions to Consider

Should the United States commit a large portion of its present defense budget to environmental programs? How can we balance possible short-term risks versus long-term ones?

If you have children, do you think they will live the way you live today? How will their lives be different? What problems do you believe must be solved in your lifetime?

5 Explore the differences between a human-centered world view and a sustainable-earth world view by asking students to draw pictures showing their own relationship to the environment. Where do students place themselves? Above and outside the picture? At the center? To one side? Discuss different ways ecologists view the human place in the environment. Then have students generate a list of environmental issues, such as rapid population growth, global warming, pollution, acid rain, and the loss of biodiversity. Ask them to rate the problems in order of the significance of their impact on people. Then have them reorder the list from a "deep ecology" perspective. Ask them to brainstorm possible solutions to each problem. Which solutions reflect a human-centered perspective, in which we shape the world to meet our needs, and which reflect an earth-centered view? Which changes would students prefer to make? Which do they think would be most effective?

6 Have students study the current environmental movement by choosing an organization – Sierra Club, Greenpeace, Earth First!, The Nature Conservancy, or Rainforest Action Network, for example – and researching its history, goals, strategy, and structure (for addresses see Resources). Which groups do students think are most effective and why? Are umbrella organizations more effective than single-issue groups? What are the pros and cons of pursuing social change through the courts, legislation, grass-roots organizing, or direct action? How do the philosophies of these groups differ? To what extent can their efforts build on one another?

Read *The Monkey Wrench Gang* by Edward Abbey (Philadelphia: J. B. Lippincott Company, 1975) and *Encounters with the Archdruid* by John McPhee (New York: Farrar, Straus & Giroux, 1971) about environmentalist David Brower (or *For Earth's Sake – The Life and Times of David Brower* by David Brower, New York: Peregrine Smith Books, 1990) and compare their attitudes about conservation and environmental activism. Encourage students to support the organizations whose work they admire through making donations, holding a fund-raising campaign, writing letters, or volunteering time.

sustainable-earth world view
A system of ethics that challenges the assumption that humans have the right or obligation to subdue nature, and instead emphasizes a respect for nature, cooperation, and simplicity.

voluntary simplicity A philosophy pursued by some individuals in affluent countries who choose to limit their standard of living so as to live in closer harmony with nature.

"walk lightly on the earth"
To adopt a lifestyle that minimizes disruption of the environment that occurs through the consumption of energy, depletion of resources, or generation of waste.

Recommended Readings

Borrelli, Peter. "The Ecophilosophers." *Amicus Journal* (Spring 1988): 30-39.

Brown, Lester R., Christopher Flavin, and Sandra Postel. "Outlining a Global Action Plan." In *State of the World 1989*, by Lester R. Brown et al. New York: W. W. Norton & Co., 1989.

Hardin, Garrett, and John Baden, eds. *Managing the Commons*. San Francisco: W. H. Freeman, 1977.

Hayes, Denis. "Earth Day 1990: Threshold of the Green Decade." *Natural History* (April 1990): 55-70.

MacNeill, Jim. "Strategies for Sustainable Economic Development." *Scientific American* (September 1989): 154-165.

Renner, Michael. "Enhancing Global Security." In *State of the World 1989*, by Lester R. Brown et al. New York: W. W. Norton & Co., 1989.

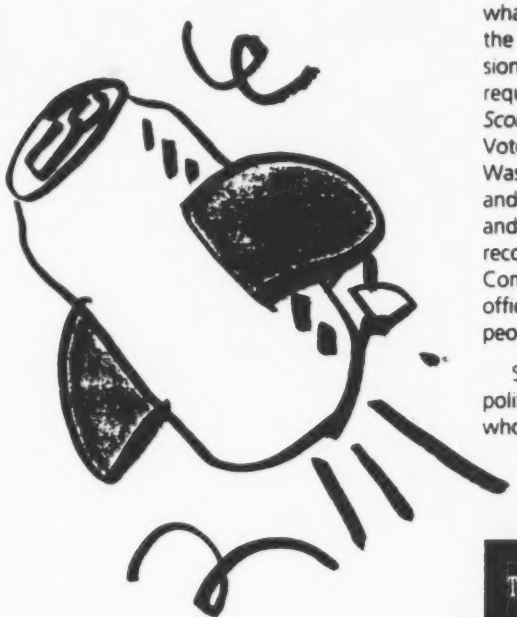
World Commission on Environment and Development. *Our Common Future*. New York: Oxford University Press, 1987.

What a Waste!

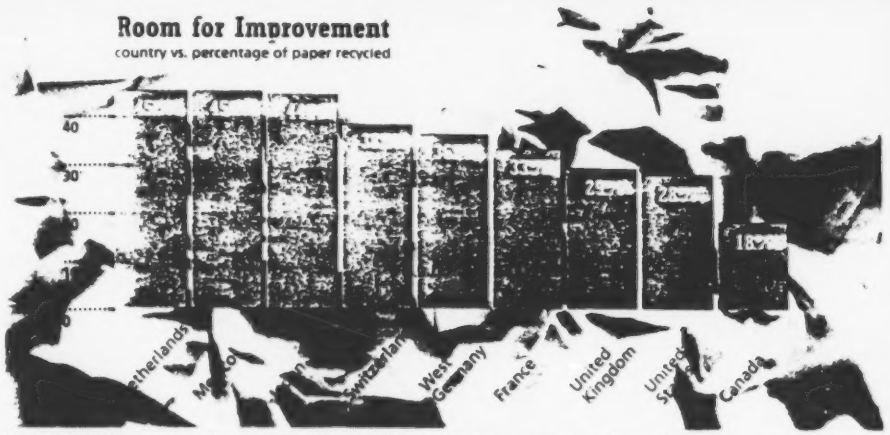
We live in a throwaway society. We throw our discarded packaging, old newspapers, and food scraps into a big plastic bag, then drag the bag out to the curb where it sits until a truck takes it away. It's all so simple that we hardly need to think about it. Or so it seems.

With some environmental scientists predicting that we have ten years to clean up our environmental act, all of us need to take a hard look at what we are thoughtlessly tossing out with the trash. What we consider waste or garbage in this country, people in other countries might consider a valuable resource. If you can't picture your empty soup cans, soda bottles, and paper cups as resources, consider the following facts.

- Americans buy about 200 million aluminum beverage cans every day.
- With all the aluminum Americans throw out each year, the U.S. could rebuild its entire commercial air fleet three times over.



- We throw out enough iron and steel to supply U.S. automakers with these important resources on an ongoing basis.
- 75,000 trees are used for the pressrun of just one Sunday edition of *The New York Times*.
- Recycling aluminum produces 95 percent less air pollution and 97 percent less water pollution and requires 95 percent less energy than mining and processing aluminum ore, yet only 29 percent of aluminum is recycled in the U.S.



Source: G. Tyler Miller, Jr. *Living in the Environment*. 6th edition. Belmont, Calif.: Wadsworth Publishing Company, 1990.

Take It to the Top

If you want to work to change environmental practices and policy, encourage change through supporting bills and ordinances on the local, state, and federal levels. Find out what legislation is being debated concerning the environment. To see how your Congressional representatives have been voting, request a copy of *The National Environmental Scorecard* from the League of Conservation Voters (1150 Connecticut Avenue, #201, NW, Washington, DC 20036). Let your senators and representatives know when you approve and disapprove of their environmental voting record. Your letters do make a difference. Commonly accepted wisdom in legislative offices is that for every letter they receive, 100 people share these views.

So how do you go about writing to politicians? Send letters directly to the people who represent you, but also send letters to the chair of the committee reviewing the particular bill you are writing about. Letters should be addressed respectfully as follows:

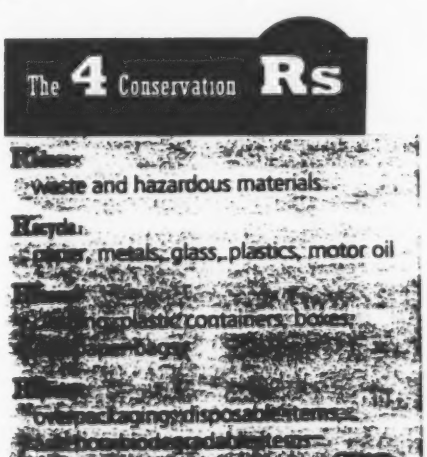
The President
The White House
1600 Pennsylvania Avenue, NW
Washington, DC 20500
Dear Mr. President:

The Honorable _____
Senate Office Building
Washington, DC 20510
Dear Senator _____

The Honorable _____
House Office Building
Washington, DC 20515
Dear Representative _____

Here are some tips for getting your point across effectively.

- Identify the bill or issue you are writing about. Be brief and to the point, no more than one page if possible.
- Don't be rude or threatening. It is the job of the members of Congress and state legislatures to represent the views of all the people who live in their district. They will be genuinely interested to hear your point of view if it is presented in a courteous, constructive manner.
- Support your position with specific reasons. For instance, if you are writing about an environmental problem in your state or neighborhood, let Congress know how the problem is affecting you, your family, and your friends.
- Don't forget to include your return address with the letter. Most mail will be answered.


The 4 Conservation Rs
waste and hazardous materials
paper, metals, glass, plastics, motor oil
overpackaging, disposable items

BEST COPY AVAILABLE

PERPETUAL PLASTICS

Most people used to have milk delivered in reusable glass bottles. Each week the milkman would leave two or three bottles of fresh milk and pick up the empty ones, keeping bottles and cartons out of landfills.

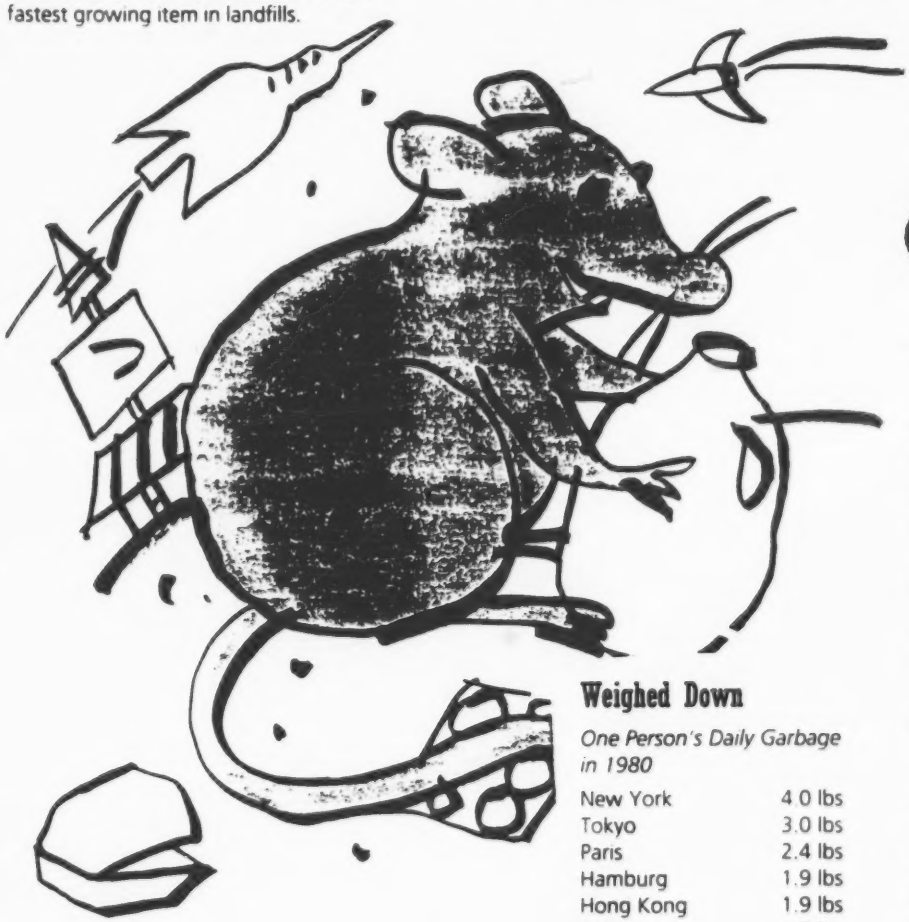
Today, most of us pick up our milk in the grocery store in plastic or cardboard containers. Water, once thought safe to drink from the tap, is now sold in plastic jugs. And large soda bottles, once glass, are also plastic now. But where do all the containers go once the liquids are gone? Most of them end up in landfills, where they will take between 200 and 500 years to degrade. With only 4 percent of plastic used for packaging being recycled in the U.S., it might help to remember a couple things about plastics.

- Plastics now account for 30 percent by volume of household waste and are the fastest growing item in landfills.

Avoid buying things in plastic containers. Look for glass and paper alternatives. Refuse to buy products that are overpackaged, and write to the customer relations department of the manufacturer (the address is usually printed on the packaging) explaining your reasons for not buying a particular item.

- Discarded plastics, including bags, balloons, and six-pack rings, kill up to 100,000 marine mammals a year. The animals swallow them or get them stuck around their mouths, making it impossible to eat or breathe.

You can do your part by avoiding plastic bags, by not releasing helium balloons, and by cutting up six-pack yokes before throwing them away. Be on the lookout for uncut yokes on the beach and in other public areas.



Weighed Down

One Person's Daily Garbage in 1980

New York	4.0 lbs
Tokyo	3.0 lbs
Paris	2.4 lbs
Hamburg	1.9 lbs
Hong Kong	1.9 lbs
Rome	1.5 lbs
Cairo	1.1 lbs
Calcutta	1.1 lbs

Source: The World Bank and Worldwatch

The Recycle Cycle

You've probably seen this symbol often enough, but do you know what it means? The three arrows stand for the three steps of recycling: **collect, recycle, reuse.** Each step plays an equally vital role in the recycling process. The last step is the one people overlook most often. Currently, it's cheaper to cut down trees than to use recycled paper to make paper products. By making a conscious decision to buy recycled products, demand for them will increase and prices will come down.

Make sure your family buys toilet paper, paper towels, stationery, and note-pads made from recycled paper. If you can't find these in your local stores, tell the store manager you'd like to see them. Write to companies and let them know you appreciate their use of recycled products.

Trash Talk

We all know doctors and lawyers use language we can't understand, but how about garbage collectors? Here are a few terms to throw around next time you want to sound in-the-know.

Making the salad; tossing salad
Heaving garbage into the truck.

Fruit wagon; tanker
The garbage truck.

Walking rice; motorized rice
Maggots.

Mungo
Good stuff that's been thrown away. "Hey, that sofa looks like good mungo."

Moon shot
When a plastic bag breaks and trash tumbles out.

G-man; garbologist
Garbage collector.

MRF (pronounced "murf")
Material recovery facility, for the processing of recyclable trash.

Adapted from "Buzzwords," Newsweek (November 6, 1989): 8

A Day in the Life of Maria

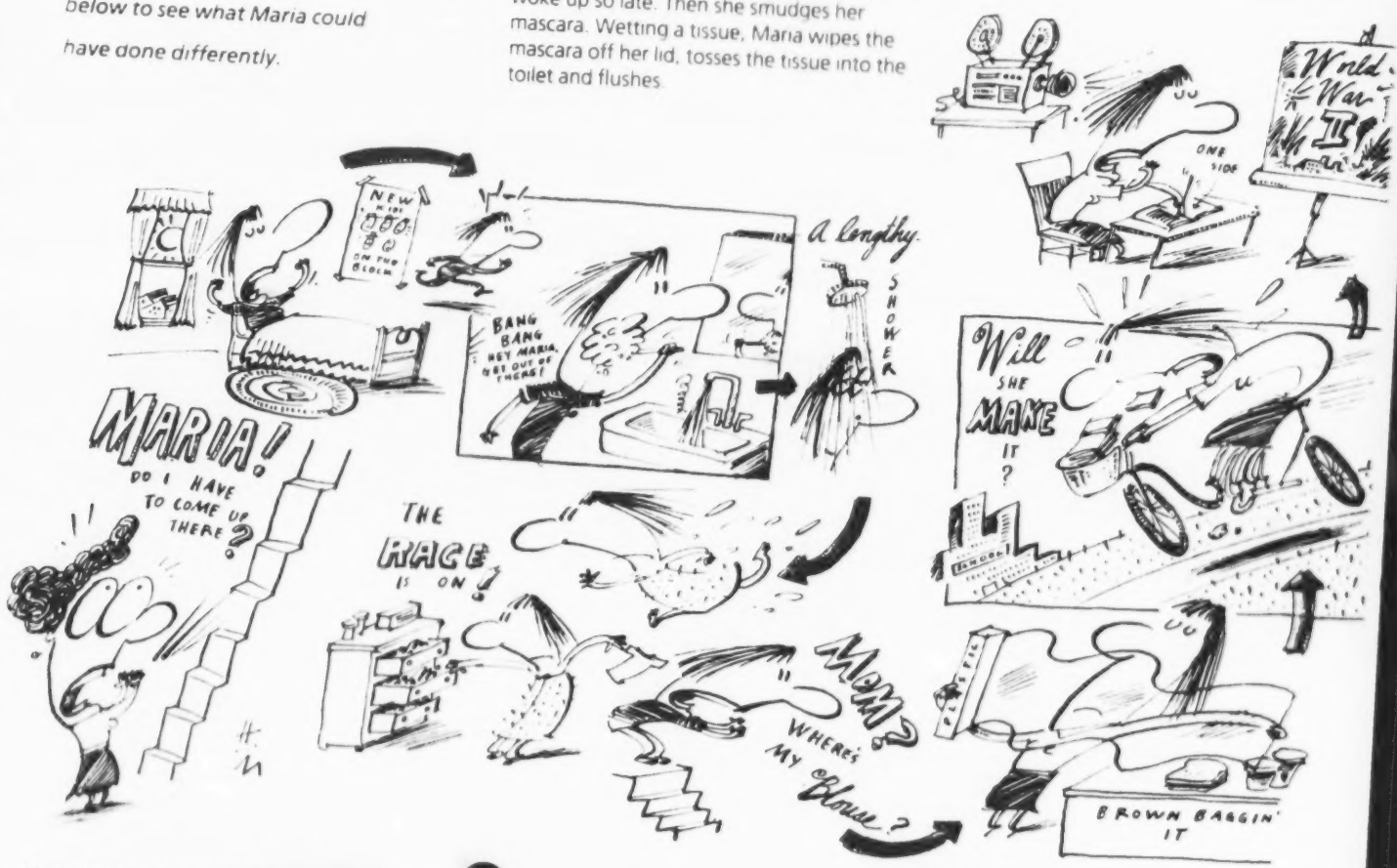
Try to find the things that Maria does throughout her day that affect the environment for better or worse. Check below to see what Maria could have done differently.

7AM

Maria wakes with a start. Her alarm clock didn't go off again and her mother is yelling at her to get up. She's going to be late. Rushing to the bathroom, Maria turns on the water while she tries to find the toothpaste. Next, she heads for the shower and slowly begins to wake up. Before she knows it, her brother pounds on the door yelling, "Get out of there, you've been in there half an hour!" After she gets dressed, it's back to the bathroom to put on her makeup. Her morning seems to be going okay, considering she woke up so late. Then she smudges her mascara. Wetting a tissue, Maria wipes the mascara off her lid, tosses the tissue into the toilet and flushes.

8AM

Too late to eat breakfast, Maria wraps a sandwich in plastic wrap, tosses it into her backpack, and jumps on her bike. School goes pretty much as usual, except for history class where Maria has to watch a film on World War II. She's pretty bored, but she takes a lot of notes because the film is going to be covered on the final. By the time the film is over, she's filled one whole section of her notebook single-sided.



Help Maria Mend her Ways

1

Maria wastes a lot of water. First, she runs the water while she brushes her teeth. Turn on the faucet only to wet your toothbrush and rinse. The same goes for shaving your beard: use water only to soap up and rinse. Maria then spends half an hour in the shower. Cut back showers to ten minutes or less. Finally, be stingy with tissues and paper towels. And never use the toilet as a wastebasket.

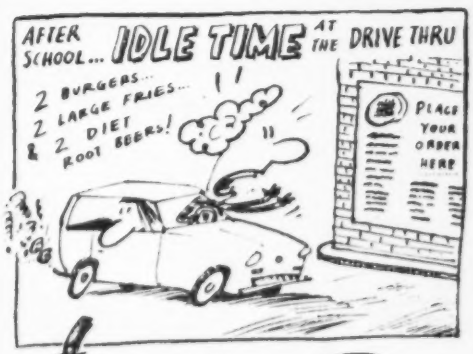
2

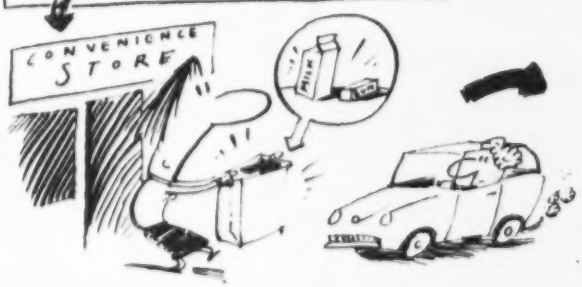
Maria wraps her sandwich in plastic wrap when she might have used wax paper. If you use aluminum foil, save it, reuse it, and find out if your local recycling center recycles it. We should give Maria points for riding her bike to school and cutting down on air pollution and greenhouse gases. She uses up the credits earned, however, by writing on only one side of her notebook pages. She could cut her paper consumption by half simply by writing on both sides.

DIFFERENCE

2PM

Maria puts her bike in the back of her friend Jane's station wagon and they drive down the street to meet two other friends for a burger. It's one of the first warm days of spring and they decide to order food at the drive-through window and eat outside. By now it's four o'clock. But before Jane drops her off, they drive by Tom's house just to see if he's home. When Maria sees he's outside, she ducks down in her seat so he won't know she's checking up on him. She's promised to show him how to change his oil on Saturday, and she's already found out where to take it to be recycled. Jane speeds past and heads towards Maria's house, but Maria remembers that she told her mother she'd pick up some milk. The two girls drive back downtown, and Maria runs into the store for a gallon of milk. She grabs a pack of gum while she's there, runs out the door and tosses the bag into the back seat.





3

Maria may ride her bike to school but she still wastes a lot of gas. She and Jane should share a ride with their other two friends and they should avoid the drive-through window (even idling the car wastes gas and gives off pollution that contributes to the greenhouse effect). Maria and Jane spend a lot of time driving back and forth. Try to plan errands with the shortest route in mind. Maria has learned to change the oil, a big plus, and knows it's a toxic waste that needs to be disposed of properly, so she gains points there. But then she takes a shopping bag when all she's bought is some milk and gum. Don't use paper and plastic bags needlessly. Better still, carry a tote bag with you when you shop.

7PM

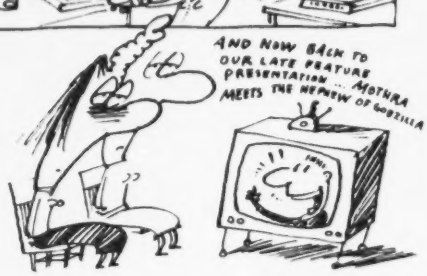
After dinner, Maria goes upstairs to do her homework. It's still a little warm, so she flips on the air conditioner. After about half an hour, she gets thirsty and goes downstairs, where she grabs the last can of soda and tosses the six-pack ring into the garbage. Just as she gets back into studying, the telephone rings. It's Jane. Maria turns down her boom box and they talk for 20 minutes. Her mother calls from downstairs to remind her that it's her turn to take out the trash. Maria grabs her soda can and yesterday's newspaper and throws them into the garbage bag. She also remembers that the batteries to her Walkman are dead, and throws them out as well. Then she drags all the bags out to the curb.

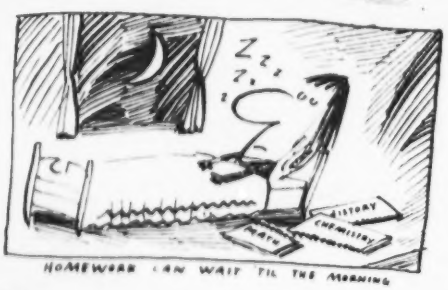
4

Using an air conditioner is a big no-no unless the heat is unbearable or a health risk. And Maria should remind her mother to buy soda in gallon bottles instead of six packs. Not only does that save on waste (one bottle instead of six), but you also avoid six-pack yokes that can strangle marine animals. She should have at least cut the yoke before throwing it away. When Jane calls, instead of turning down the volume, she should have turned her boom box off. Then she tosses out her newspaper and soda can instead of separating the trash for recycling. Finally, never throw out batteries in the trash. They usually contain mercury or cadmium which are both toxic waste. Find out about your community's hazardous waste pick-up.

9PM

When she comes inside, her sister is watching TV in the living room. Maria joins her, watches TV for about an hour, and then goes upstairs to go to bed. She flips off the boom box and air conditioner and crawls into bed, hoping that she can finish her homework in the morning.

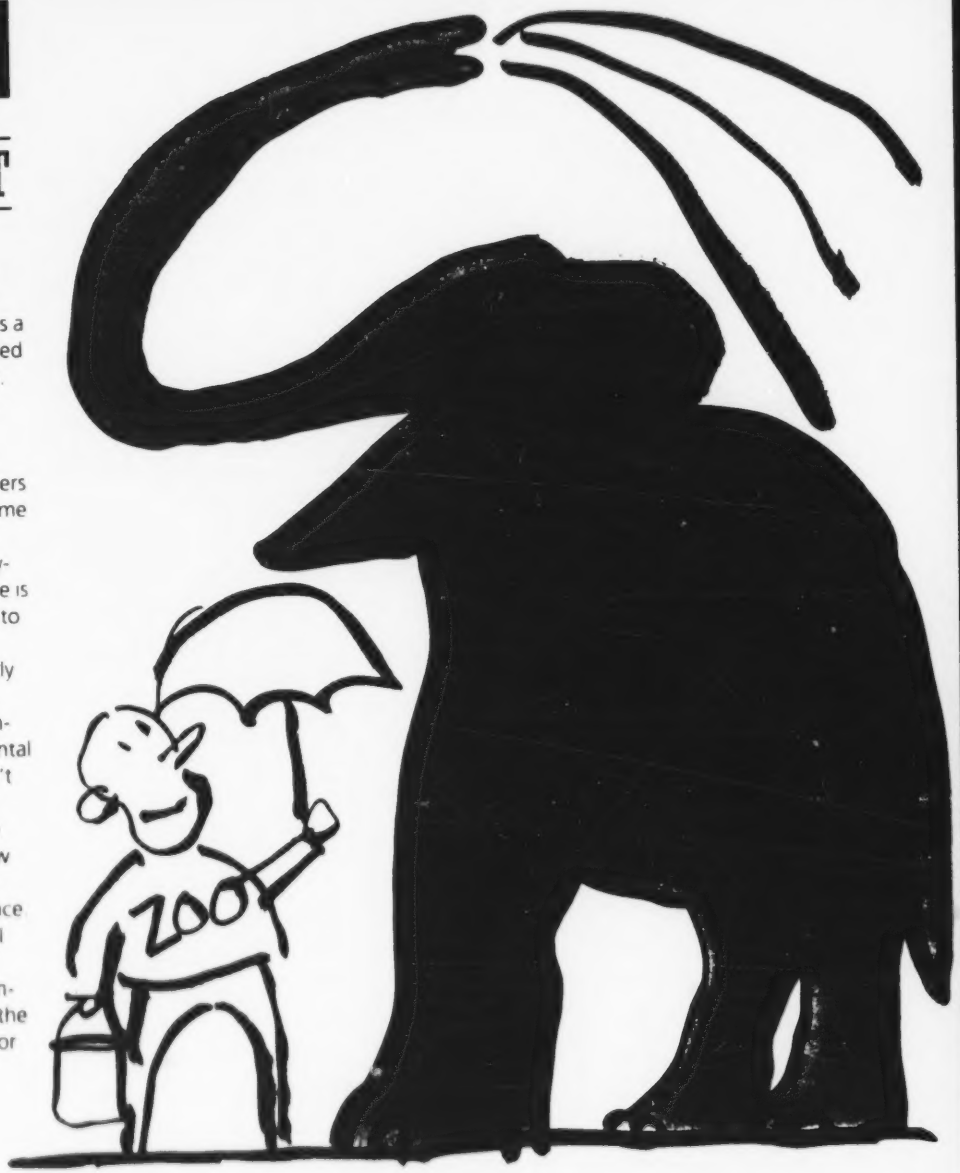




5

Finally, a reminder to turn things off when you leave the room. When she went downstairs, Maria left her boom box on (the volume was down and she didn't hear it, remember?) as well as the air conditioner. Turn off lights and other appliances when you go out.

WORKING FOR THE ENVIRONMENT



You don't have to be able to hike a 14-mile trail, diagram the chemical composition of auto emissions, or aspire to spend your life as a forest ranger to think about a career dedicated to protecting and restoring the environment. Thousands of writers, artists, lawyers, scientists, and educators have found fulfilling careers working on environmental issues.

Some work in urban office buildings, others spend their time in forests and wetlands. Some work alone as consultants, others work in organizations that have hundreds of employees. No matter where your interests lie, there is a place for you to put your skills and talents to work for environmental issues.

Even if you do not choose a career directly associated with the environment, you can choose a job with a company that is environmentally responsible. Check the environmental record of companies you apply to. And don't forget about the thousands of volunteer opportunities. You may not want to devote your whole life to the environment, but how about a few hours a week? Volunteering is also an excellent way to gain work experience.

For those interested in an environmental career, the following page offers a small sampling of job opportunities in the environment. For a more complete listing, consult the career development section of your library or one of the resources listed below.

Environmental volunteer and field-research opportunities

American Hiking Society
Volunteer Vacations
P.O. Box 86
Dept. VV/AHS
No. Scituate, MA 02060
AHS sponsors two-week-long programs in national parks, national forests, and state parks where volunteers build new trails, maintain old ones, and help with a variety of other needed tasks like building and maintaining bridges. For more information, send a stamped, self-addressed long envelope to the address above. AHS also publishes *Helping Out in the Outdoors*, a listing of more than 1,500 volunteer jobs and internships on public lands around the country. To order a copy, send $3 to: AHS/Helping Out, 1015 31st Street, NW, Dept. 18, Washington, DC 20007.

Earthwatch Education Awards
680 Mt. Auburn Street – Box 403R
Watertown, MA 02272
(617) 926-8200
Earthwatch Education Awards are financial aid given to students and teachers (of all disciplines, not just science) to participate in Earthwatch field research. Earthwatch recruits volunteers to work on scientific research expeditions around the world. Subjects include archaeology, geography, anthropology, folklore, public health, ecology, and conservation biology. Recent projects have led volunteers to Minnesota to track timber wolves, to South Korea to trace the origins of Korean agriculture, to Tunisia to excavate the ancient city of Carthage, and to Australia to record bush craft and folklore.

National Wildlife Federation
Resources Conservation Internship Program
1400 16th Street, NW
Washington, DC 20036-2266
(202) 797-6800

Northwest Trails Association
16812 36th Avenue West
Lynwood, WA 90836
The NTA publishes *Helping Out in the Outdoors: A Directory of Volunteer Jobs in State and National Forests*.

Sierra Club Outing Department
730 Polk Street
San Francisco, CA 94109
(415) 776-2211

Student Conservation Association
High School Work Group Program
P.O. Box 550
Charlestown, NH 03603
(603) 826-4301
Every summer, SCA offers a high school program for students 16 to 18 years of age. Projects last from four to five weeks and have no tuition fee. Students live and work out of a field camp in a national park, national forest, wilderness, or other natural area. Projects include trail construction and maintenance, wildlife habitat improvement, and shelter or bridge construction.

Architecture and planning

Some architects specialize in designing buildings that are energy-efficient, passive solar, and complementary to the local environment. The planning profession can be broken down into urban planners, who work in cities and towns on issues of transportation, housing, industrial development, and social planning; regional planners, who work on a larger geographical scale and often attack land-use, environmental, and economic issues; and policy planners, whose territory is defined by issues rather than geography and who develop and implement policies in such areas as the environment and economics. Environmental planning is a specialization practiced by urban, regional, and policy planners, that studies how to balance human needs and the use of the world's resources.

Education

In addition to the challenge of teaching in a traditional classroom setting, educators who specialize in the environment often find jobs in summer camps, nature reserves, and environmental education centers, as well as in zoos, parks, and museums.

Environmental action groups

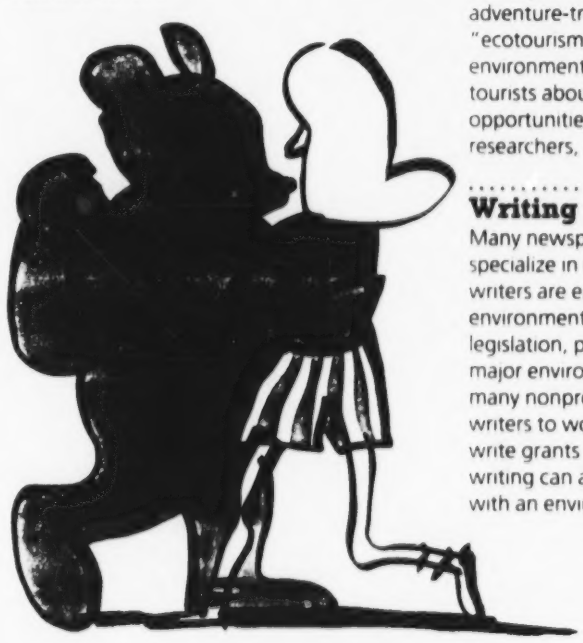
Activist organizations are staffed with people who contribute a variety of skills to the organization. Larger organizations may have an executive director, an assistant director, a public-education coordinator, and a development (funding) director. These people often have support personnel who develop educational materials, solicit funding from appropriate organizations, and inform the public through telephone campaigns, printed material, and newspaper editorials. Other activists work as lobbyists who try to persuade members of Congress and state legislatures to vote for environmentally sound legislation.

Lawyers and public health

Lawyers work for a large variety of clients – from organizations like Greenpeace to large chemical manufacturers who are facing environmental suits. Likewise, there are doctors, nurses, and public health officials who specialize in environmental health and safety.

Parks and recreation

Private and public parks and campgrounds provide jobs for thousands of people. Some jobs are seasonal, others are year-round. In addition to park rangers, program supervisors, and recreation directors, jobs include campground hosts who greet campers and supervise campgrounds, trail crew members who repair hiking trails, and office personnel who work in information booths and in resource centers.



Science

Although the field of environmental science is itself rich with opportunities, there are also plenty of jobs for people whose interests lie in biology, chemistry, and engineering. Job opportunities are very diverse, ranging from air- and water-quality control to hazardous- and solid-waste management, land and water conservation, and fishery and wildlife management. Recent job postings included opportunities for a fish and wildlife scientist at a state department of natural resources, an elephant keeper at the Philadelphia Zoo, a biological lab technician at a New York fishery, and a waste-management engineer for the state of California.

Travel

If you're interested in traveling, especially to exotic places, many travel agencies and adventure-travel companies now specialize in "ecotourism": tours that do not disrupt the environment being visited and that educate tourists about the ecology of the area. Job opportunities here include tour organizers, researchers, and guides.

Writing

Many newspaper and magazine writers now specialize in environmental issues. Some writers are experts in the science of the environment, others are concerned with legislation, public education, or the work of major environmental groups. In addition, many nonprofit environmental groups hire writers to work on publicity campaigns and to write grants to insure future funding. Speechwriting can also be an exciting job for a writer with an environmental background.

Volunteers for Peace
43 Tiffany Road
Belmont, VT 05730
VFP organizes International Workcamps, described as "a fully internationalized short-term 'peace corps.'" Located in the United States and 36 countries around the world, work and conditions vary greatly. Construction, restoration, environmental, social, agricultural, and maintenance work-camps are common. Minimum age for most camps is 18 but there are some opportunities for ages 16 to 18 in France and Germany. Work-camps last two to three weeks and cost $80.

Related books

Anzalone, Joan, ed. *Good Works: A Guide to Careers in Social Change*. New York: Dembner Books, 1985.

The CEIP Fund. *The Complete Guide to Environmental Careers*. Washington, DC: Island Press, 1990.

Fanning, Odom. *Opportunities in Environmental Careers*. Lincolnwood, IL: VGM Career Horizons/National Textbook Co., 1986.

Shapiro, Stanley Jay. *Exploring Environmental Careers*. New York: Richard Rosen Press, 1982.

Volunteer! The Comprehensive Guide to Voluntary Service in the U.S. and Abroad. New York: Council on International Educational Exchange, 1988.

For more information

If you want to learn other ways you can change little things in your life to protect the environment, an excellent book is *Fifty Simple Things You Can Do to Save the Earth* from the Earthworks Group. If you can't find it in your local bookstore or library, you can order it for $4.95 plus postage from Earthworks Press, Box 25, 1400 Shattuck Avenue, Berkeley, CA 94709. If you can't find recycled paper products in your neighborhood, order a catalog from Earth Care Paper, P.O. Box 3335, Madison, WI 53704; (608) 256-5522. For environmentally safe household products, recycled products, water-saving devices and the like, order a catalog from Seventh Generation, 10 Farrell Street, South Burlington, VT 05403, (800) 456-1177.

Resources

General Information

Environmental Education Materials for Teachers and Young People (Grades K-12)
U.S. Environmental Protection Agency
Office of External Relations and Education
Youth Programs (A-108 EA)
Room 823 W2
401 M Street, SW
Washington, DC 20460
202/382-4454
This annotated list of educational materials on environmental issues ranges from workbooks and lesson plans to newsletters, films, and computer software. The EPA also puts out a number of other pamphlets, including *Solid Waste Dilemma: An Agenda for Action* and *Let's Recycle: Lesson Plans for Grades K-6 and 7-12*.

Environmental Resource Compendium
PBS Elementary/Secondary Service Department PR
1320 Braddock Place
Alexandria, VA 22314
This 64-page publication offers hundreds of resources for classroom and community use. It includes listings of telecourses, broadcast programming, nonbroadcast programming for classroom use, slide shows and filmstrips, books for grades K-12, curriculum materials, posters, computer resources, outreach ideas, resource facilities, and environmental groups. Send a $10 check or money order and enclose a mailing label with each order.

Seventh Generation
10 Farrell Street
South Burlington, VT 05403
(800) 456-1177
Seventh Generation publishes a mail-order catalog of environmentally safe products. It also offers two booklets for $3.75: *110 Things You Can Do for a Healthy Environment* and *Field Guide to More Than 100 Environmental Groups*.

Educational Materials

American Society for Environmental Education
1200 Clay Street, #2
San Francisco, CA 94108
(415) 474-7123
The ASEE distributes *Environmental Education Study Projects for High School Students*, a 14-page booklet on environmental problem-solving through independent study, and *A Basic Source List of Environmental Education Materials*, a 20-page list of books, periodicals, and bibliographies.

ERIC Clearinghouse for Science, Mathematics and Environmental Education
(ERIC/SMEAC)
Ohio State University
1200 Chambers Road, Room 310
Columbus, OH 43212
(614) 292-6717
ERIC (Educational Resources Information Center) provides access to literature dealing with education, including about 10,000 documents and articles related to environmental education. These publications can be located at nearly 800 sites with ERIC collections. ERIC/SMEAC also develops special publications, including digests, activity manuals, and directories.

Global Tomorrow Coalition
1325 G Street, NW, Suite 915
Washington, DC 20005
(202) 628-4016
The Global Issue Education Packet, based on the *Citizen's Guide to Global Issues*, contains curriculum materials for students at the K-12 level on issues concerning the global ecosystem.

Institute for Environmental Education
32000 Chagrin Boulevard
Cleveland, OH 44124
(216) 464-1775
The Institute for Environmental Education distributes many publications, including a variety of case histories, *Environmental Education Guide for Teachers, Tuning the Green Machine: An Integrated View of Environmental Systems*, a series of curriculum activity guides, and *The Nature Conservancy's Student Stewardship Program – Student's and Teacher's Manual*.

North American Association for Environmental Education
5995 Horseshoe Bend Road
P.O. Box 400
Troy, OH 45373
(513) 698-6493
The NAEE assists and supports the work of individuals and groups engaged in environmental education, research, and service. Membership includes subscriptions to *Current Issues* (annual) and *The Environmental Communicator* (bimonthly), which contains information on model programs and curricula.

Race to Save the Planet College Telecourse
The Annenberg/CPB Project
c/o Intellimation
P.O. Box 1922
Santa Barbara, CA 93116-1922
(800) LEARNER
Race to Save the Planet is being offered as a college-level television course by many colleges and universities. Call the education office at your local public television station to find out if there is a college offering the course near you. If not, a number of colleges can offer you credit and instructional services no matter where you live. Contact The Annenberg/CPB Project for information about these colleges, as well as videocassettes, print materials, and off-air taping and duplication licenses.

The World Game Institute
University City Science Center
3508 Market Street, Suite 208
Philadelphia, PA 19104
(215) 387-0220
According to R. Buckminster Fuller, the object of The World Game is "to make the world work for 100 percent of humanity in the shortest possible time through spontaneous cooperation without ecological offense or the disadvantage of anyone."

Zero Population Growth
Population Education Program
1400 Sixteenth Street, NW
Suite 320
Washington, DC 20036
(202) 332-2200
ZPG distributes a variety of educational materials, including *Global 2000 Countdown Kit, EDventures in Population Education, For Earth's Sake: Lessons in Population and the Environment*, and *Kenya: A Country in Transition*.

Environmental Groups

This is just a sample of the many environmental groups. To get more complete lists, see the entries for the *Environmental Resource Compendium* and *Seventh Generation* under **General Information**.

African Wildlife Foundation
1717 Massachusetts Avenue, NW
Washington, DC 20036
(202) 265-8394

Chipko
P.O. Silyara via Ghansale
Tehri-Garwhal
Uttar Pradesh
249155 India
The Chipko Movement, started in 1973, is one of India's and the world's most effective groups in creating awareness of the need for trees, forests, and ecological preservation.

Coalition for Environmentally Responsible Economies
711 Atlantic Avenue
Boston, MA 02111
(617) 451-3661
This group developed the Valdez Principles, a set of environmental principles generated in response to the Exxon Valdez oil spill. A copy may be obtained from the above address.

Earth First!
P.O. Box 5871
Tucson, AZ 85703
Earth First! employs a militant approach to protect wilderness and biodiversity. Tactics include confrontation, guerilla theater, direct action, and civil disobedience.

Greenpeace
1436 U Street, NW
Washington, DC 20009
(202) 462-1177
Greenpeace garners a lot of media attention for its aggressive commitment to environmental protection.

League of Conservation Voters
1150 Connecticut Avenue, NW, #201
Washington, DC 20036
The National Environmental Scorecard presents the voting records of members of Congress on environmental legislation. Students can use the voting charts to see how their representatives' votes jibe with their campaign promises.

National Audubon Society
613 Riversville Road
Greenwich, CT 06831
(203) 869-5272
The National Audubon Society offers a variety of educational materials, including *Living Lightly on the Planet, Volume 1 (Grades 7-9)* and *Volume 2 (Grades 10-12)*. The Audubon Hotline, (202) 547-9017, is a recorded message providing background information and an update on the Society's priority issues. The message is updated weekly.

National Recycling Coalition Inc.
1101 30th Street, NW, Suite 305
Washington, DC 20007
(202) 625-6406
NRC is working on several information packets, including *How to Set Up a Recycling Program, General Information and Statistics*, and a resource list for educators. In addition, they are compiling a national database dedicated to recycling.

National Wildlife Federation
1400 16th Street, NW
Washington, DC 20036
(202) 797-6800
The Federation publishes *The Conservation Directory*, a comprehensive listing of government and nongovernment organizations engaged in conservation work at the state, national, and international levels. The group also distributes the *Class Project Program* to enhance existing middle school science and social-studies curricula in six content areas: energy use, environmental issues, forest watershed management, hazardous substances, wetlands, and wildlife habitat.

The Nature Conservancy
1815 North Lynn Street
Arlington, VA 22209
(703) 841-5300
The Nature Conservancy buys and preserves wildlife habitats around the country. The group also administers The Latin American Program, which has engineered a "debt-for-nature" swap with Costa Rica. As part of the swap, more than 355,000 acres of Costa Rican habitat will be protected. The group has completed a similar deal with Ecuador, and is considering swaps with Peru, Guatemala, Brazil, and Jamaica.

Sierra Club Headquarters
730 Polk Street
San Francisco, CA 94109
(415) 776-2211

World Wildlife Fund
1250 Twenty-Fourth Street, NW
Washington, DC 20037
(202) 293-4800

Rain Forest Groups

Children's Rain Forest
P.O. Box 936
Lewiston, ME 04240
(207) 784-1069
The Children's Rain Forest, like the Programme for Belize, uses donated funds to purchase tracts of rain forest.

Conservation International
1015 18th Street, NW
Suite 1000
Washington, DC 20036
(202) 429-5660
Conservation International, a membership organization, supports locally based conservation efforts in 17 countries around the world. Its activities emphasize tropical rain forests as well as the temperate rain forests of British Columbia and Alaska.

Cultural Survival, Inc.
11 Divinity Avenue
Cambridge, MA 02138
(617) 495-2562
Cultural Survival works with indigenous peoples faced with cultural change. They are engaged in a marketing project aimed at importing sustainable resources from the rain forest for companies to use in their products. Commercially available products that make use of such imports include Ben & Jerry's Rain Forest Crunch ice cream, lotions and oils from The Body Shop, and Rain Forest Crunch candy.

Friends of the Earth
218 D Street, SE
Washington, DC 20003
(202) 544-2600
FOE is committed to the conservation and protection of the earth and its resources. The group publishes the *Good Wood Guide* to help consumers avoid buying wood harvested in rain forests. Order from the UK office: FOE-UK, 26-28 Underwood Street, London N1-7JU, England.

Programme for Belize
P.O. Box 1219
McLean, VA 22101-1219
(703) 506-0175
The Programme uses donations to purchase tracts of rain forest in Belize.

Rainforest Action Network
301 Broadway, Suite A
San Francisco, CA 94133
(415) 398-4404

Telecommunications and Other Networks

Global Laboratory Project
TERC (Technical Education Research Centers)
2067 Massachusetts Avenue
Cambridge, MA 02140
(617) 547-0430
TERC offers a number of telecommunications networks. The Global Laboratory Project links teachers, students, and scientists throughout the world who are investigating global ecology and human-induced climate change. LabNet is a teacher enhancement program for physics and physical science teachers in grades 9-12. The project's mission is to motivate and support high school teachers to do more experimental, collaborative, project-based instruction. In TERC Star Schools Project, students in grades 7-12 engage in student-originated, collaborative investigations in science and mathematics.

Institute for Global Communications EcoNet
3228 Sacramento Street
San Francisco, CA 94115
(415) 923-0900
EcoNet allows users to post events on international bulletin boards, find the latest information on environmental topics, send messages and documents, and talk, plan, and work with others in the United States and 70 other countries who are working on or interested in environmental issues. Databases on educational materials and resources will be available in the near future.

National Geographic Kids Network
National Geographic Society
Educational Services
17th and M Streets, NW
Washington, DC 20036
(202) 857-7000
(800) 342-4460
National Geographic Kids Network is a telecommunications-based science curriculum for grades 4-6. Students participate in large-scale, cooperative experiments and share their results with students throughout the world. Each Kids Network curriculum unit includes computer software, color booklets for students, a teacher's guide with lesson plans, reproducible activity sheets, and wall maps.

World Wise Schools Program
U.S. Peace Corps
1990 K Street, NW
Washington, DC 20526
(800) 424-8580, ext. 2283
Using a more low-tech approach, World Wise Schools Program offers students a chance to correspond with their peers in third-world countries and to exchange materials such as slides and artwork.

Books

At last count, over 55 trade books had been published on environmental subjects in the past year. For a list of books published around the time of Earth Day, see "Earth Day Anniversary Celebrated with Bumper Crop of Books," by Beth Levine (in *Publishers Weekly*, March 16, 1990, pp. 41-44). Our personal favorite is *50 Simple Things You Can Do to Save the Earth* (The Earthworks Group. Earthworks Press, 1990). For lists of fiction and nonfiction books for students, see the *Environmental Resource Compendium* (listed under **General Information**) or the sources listed below. We have also listed a handful of specific titles that fill information gaps or offer valuable source material.

***Books for Young People on Environmental Issues* (Grades K-12)**
Public Information Center (PM-2118)
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460
(202) 382-2080

Environmental Book List
Sierra Club
Public Affairs
730 Polk Street
San Francisco, CA 94109
(415) 776-2211
The Sierra Club recommends the books on this list as essential to understanding the environmental movement.

Island Press Annual Environmental Source Book
Island Press
P.O. Box 7
Covelo, CA 95428
(800) 628-2828, ext. 416
This free catalog lists 130 books, some new, some conservation classics.

Specific Titles

Gaia: An Atlas of Planet Management
Myers, Dr. Norman, ed. New York: Anchor Press Doubleday, 1984. This book features a wealth of data, vivid graphics, and authoritative text based on contributions from more than 100 authorities on global environmental, political, and social issues.

The Global Ecology Handbook: What You Can Do about the Environmental Crisis
Corson, Walter H., ed. Boston: Beacon Press, 1990. Called the "practical supplement" to the *Race to Save the Planet* series from The Global Tomorrow Coalition, this book provides the latest information on major environmental issues and features extensive resource lists of books, articles, periodicals, audio-visual materials, and teaching aids.

Keepers of the Earth: Native American Stories and Environmental Activities for Children
Caduto, Michael J., and Joseph Bruchac. Golden, Colo.: Fulcrum, Inc., 1988. Although this book is more appropriate for grades K-8, many activities can be modified for older students.

World Resources 1990-91
Compiled by The World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development Programme. New York: Oxford University Press, 1990. *World Resources* is an exhaustive source of environmental information, data, graphs, and case studies. The World Resources Institute is currently working on a teacher's guide to accompany this book. For more information, contact WRI, 1709 New York Avenue, NW, Washington, DC 20006.

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Off-Air Taping Rights
All programs in this series may be recorded and shown for educational use within seven days directly after broadcast. Off-air taping licenses are also available. To purchase an off-air taping license to use as a resource in courses or for your media library, call 1-800-LEARNER or the PBS Adult Learning Service at 1-800-257-2573. $100 for the series; $15 per program. (Price listed is for one set of tapes for life-of-tape.)

Closed Captioning
Race to Save the Planet is closed captioned, a process which translates television's soundtrack into written words on the screen. Captions for these and other television programs can be accessed through the use of a special decoder. For more information about captions or decoders, please contact The Caption Center, WGBH, 125 Western Avenue, Boston, MA 02134, (617) 492-9225.

Dear Educator,

Please help us help you! Take a moment to answer the questions below and return to WGBH, Print Projects, 125 Western Avenue, Boston, MA 02134. Returning this form will ensure that your name is entered on our mailing list to receive advance information about future WGBH educational materials. If you would like to keep your guide intact and don't have access to a copier, please write us a letter. Thank you!

School .....

Name .....

Street .....

City ..... State ..... Zip .....

Telephone number .....

Grade and subject you teach .....

Did you assign the series? Did you watch all or only some of the programs? Did students watch it at home or in class? What were their responses?

How did you use this guide? Were the *Activities* and *Questions to Consider* useful in your classroom?

Did you distribute the *Student Pages* to your class? How did they respond?

How could we improve our teachers' guides in the future?

What other environmental, science, or social-issue programming would you like to see developed by public television?